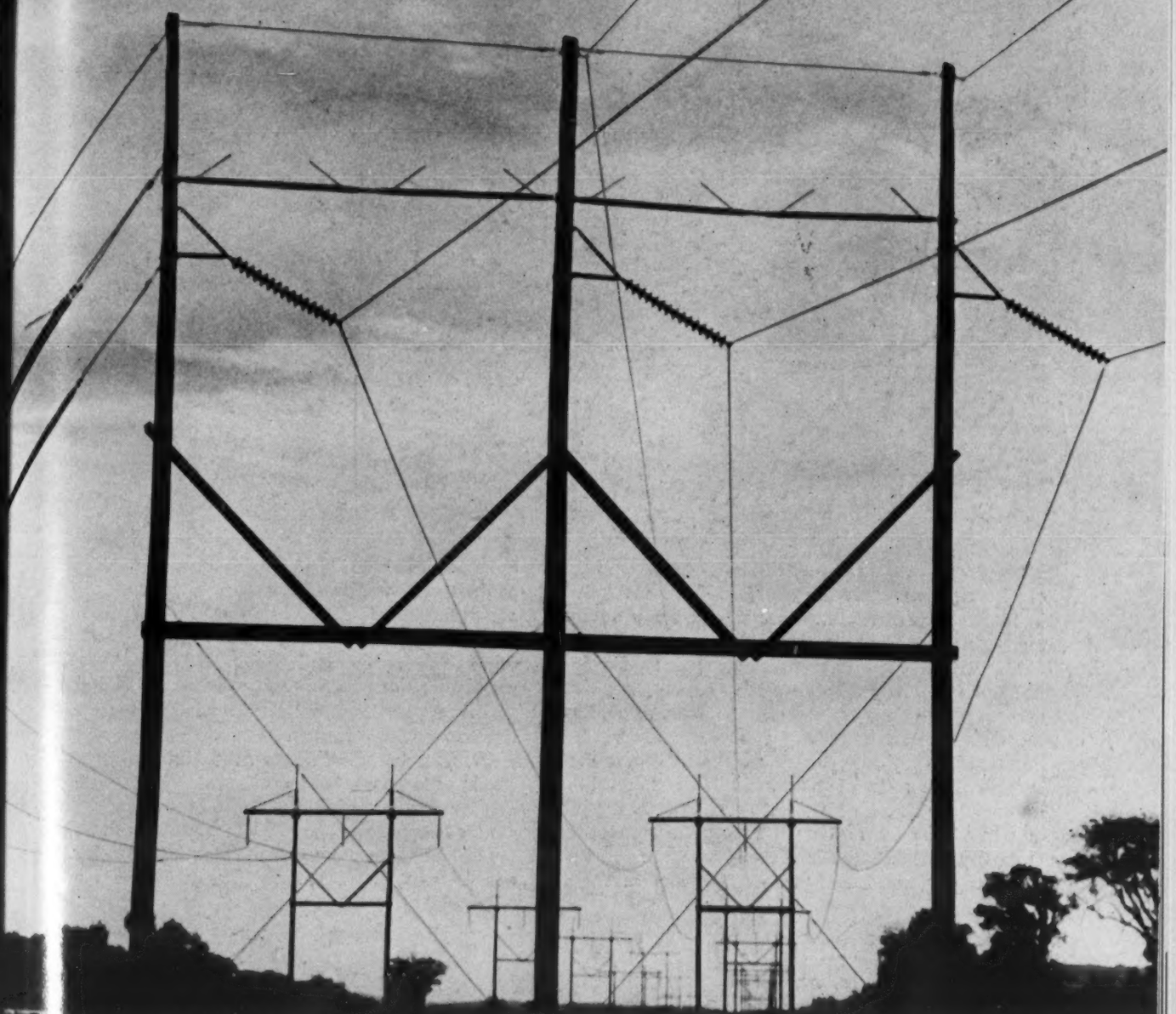
Electrical World.

FEBRUARY 6, 1913



Designs for the Future

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will include All-Metal Thermometers

More and more, designers of tomorrow's products are incorporating WESTON *all-metal thermometers* in their specifications because of the many advantages these thermometers provide.

For critical temperature requirements, its *1% full scale accuracy,* and its ability to maintain that accuracy over longer periods, are most appealing. This *long-term* accuracy is made possible by WESTON'S simplified, all-metal thermometer construction. There is no gas nor liquids employed . . . no capillary . . . no involved mechanisms. Simply one moving part, and even that part is made of enduring metal. Thus it withstands vibration and over-ranging, and is self-protected against mechanical abuse. Moreover, it has an attractive, dial-type scale which can be read from a distance . . . *easily and accurately!*

What appeals to designers of *all* types of equipment and appliances, however, is the fact that the physical form of this thermometer lends itself so readily to problems of design. It can be designed *into* a product, rather than made an accessory thereto.

While sales of WESTON all-metal thermometers are at present limited to essential requirements, descriptive bulletin giving complete specifications will gladly be sent to design engineers on request. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 54 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

February 6, 1943 — Vol. 119, No. 6

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Contents

Wartime Contributions Absorb A.I.E.E. Sessions 45

Emergency loadings of systems and equipments, methods to increase capacity and to improve performance of existing facilities, developments in design and operation to cope with shortages in manpower and materials

Wood Structures for 230-Kv. Transmission 38
O. S. CLARK, U. S. Engineers Office, Cooperstown, N. Y.

Bare Neutral Saves Critical Material 40
J. C. RUNYON, Consulting Engineer, Washington, D. C.

Tube Pitting Traced to Unequal Water Flow 43
RALPH BRISCOE, Detroit Edison Company

Telephone Service Over Rural Power Lines Studied 44

Priorities Problems 53

Editorials ..... 37 and 54

Washington Comment 56

News of the Week 57

How 65

Load Servicing 88

New Equipment 94

News About People 99

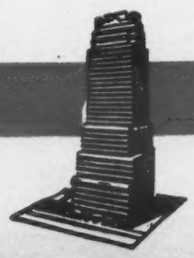
Manufacturing and Markets 108

Recent Rate Rulings 112

Recent Legislation 113

Sales Opportunities 114

Index of Advertisements 122



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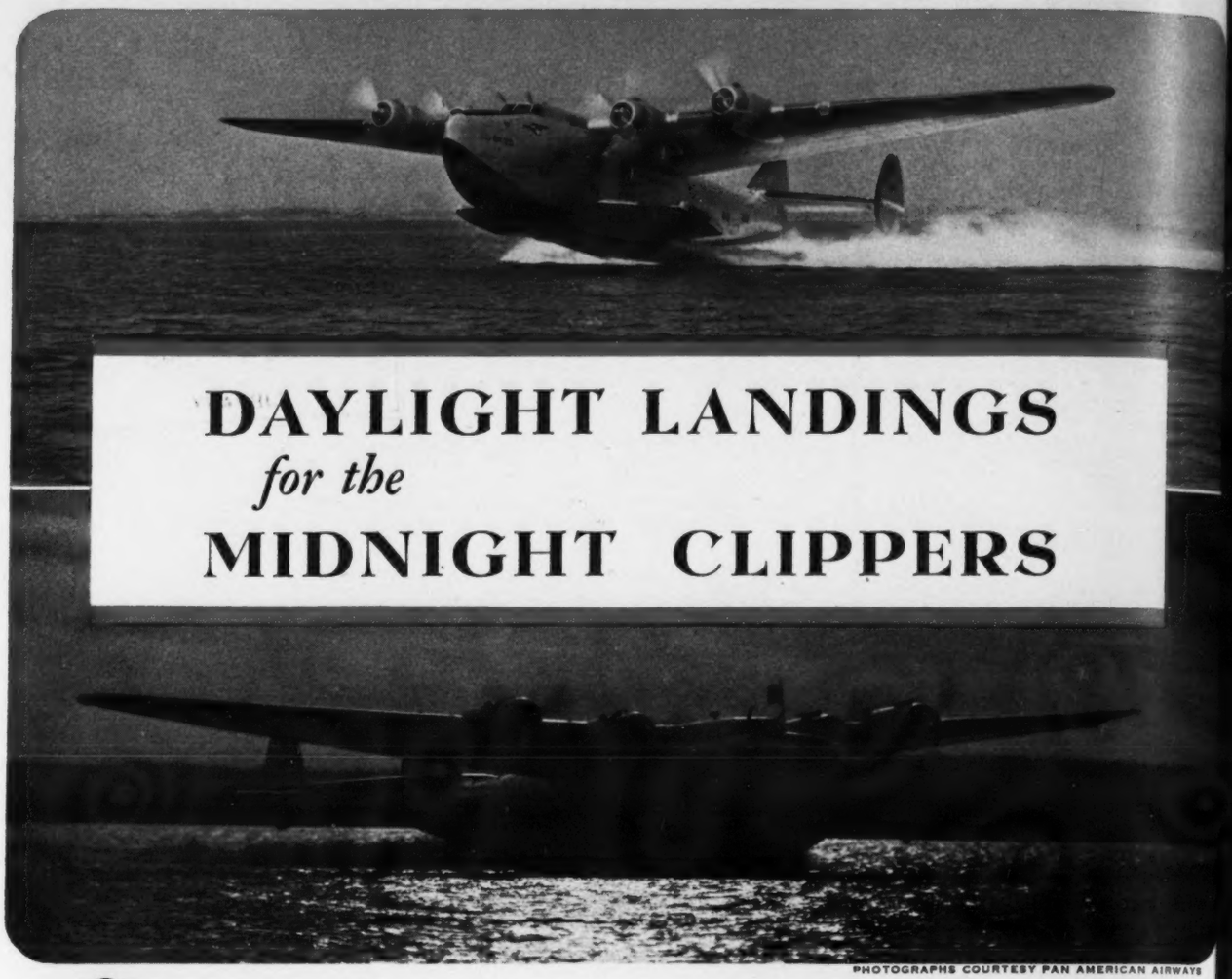
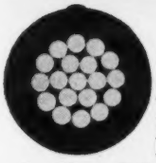


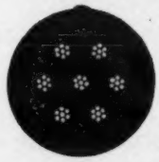
DAYLIGHT LANDINGS *for the* MIDNIGHT CLIPPERS

PHOTOGRAPHS COURTESY PAN AMERICAN AIRWAYS



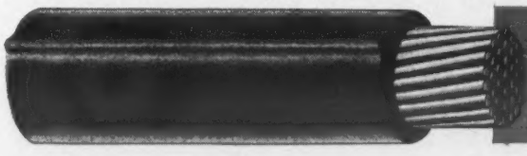
From the Golden Gate to the China Sea, peace-time passengers of Pan American Airways marvelled to see night turn into day for the after-dark landings of the Trans-Pacific Clippers. In Honolulu, Midway, Wake, Guam and Manila, the electrical communications and flood beacons, searchlights and landing lights used dependable Okosheath cables for an unfailing supply of power. What is happening now at these storied stepping stones across the world's mightiest oceans and where their Clippers now fly is clothed in military secrecy. Clippers and Okosheath alike, you may be sure, are on clock-around duty wherever America needs them most.

Okosheath is a tough, long-lived rubber compound, closely resembling a solid truck tire in its strength and wear-resisting features, and serves both as an insulation and protective covering. It resists moisture, chemicals, heat and rough handling. It eliminates the necessity for lead or other metal coverings and their common troubles such as induced sheath losses, electrolysis, corrosion, crystallization and the lack of flexibility. The rugged Okosheath non-metallic sheath eliminates complicated fibrous coverings or metal tapes which make splicing a tedious, time-consuming job, requiring expert workmanship.



Okosheath cannot at present be supplied because of its high rubber content, but it will again be available after the war, with improvements. However, Okonite's many years of continuous research have produced other cable insulations – developed from synthetics and plastics – that are today replacing scarce and even unobtainable war materials. Some of them must remain closely guarded secrets for the duration, but others are already proving of immense value to American industry! If you have a cable problem—Okonite can help you solve it.

THE OKONITE COMPANY
Passaic, New Jersey
Offices in principal cities



OKONITE Insulated Wires and Cables

Electroline FIEGE

HEAVY-DUTY COUPLING

FOR SPLICING COPPER STRAND (300 to 1000 MCM)

Gives you these Big ADVANTAGES

1 **HIGH PRESSURE**—Metal to metal contact under high pressure gives ultimate electrical and mechanical strength.

2 **HIGH CONDUCTIVITY**—Its resistance is less than an equivalent length of the conductor itself.

3 **STRONGEST** TYPE OF COUPLING when used with steel, copper or composite strands.

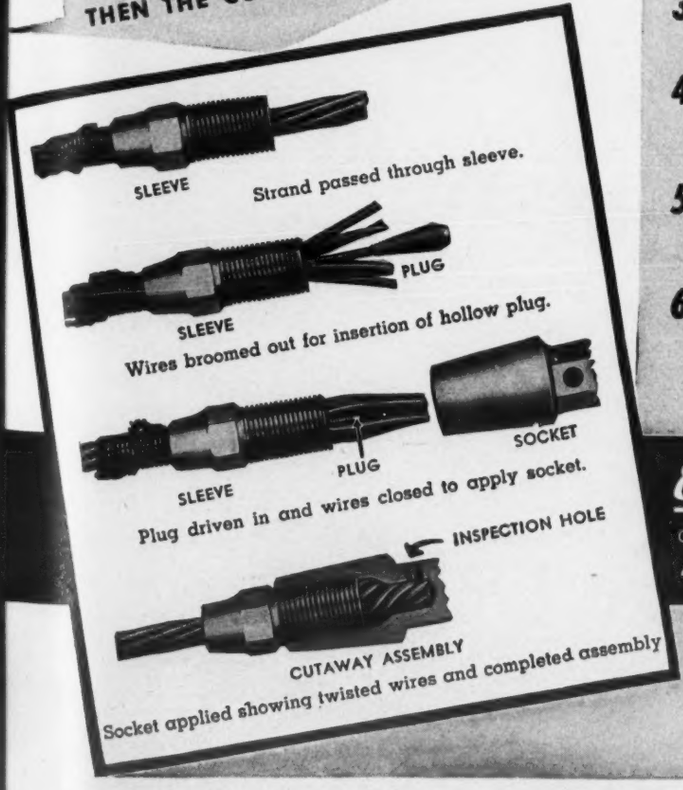
4 **NO WASTE** of conductor, in fact the coupling itself can be used over and over again. Easily disconnected . . . free from corrosion.

5 **SOLDERLESS**—No hot metal is needed. No special tools required. Common tools make or unmake the connection.

6 **EASY INSPECTION**—Inspection holes make visual inspection of the joint quick and positive. No guess work. A sound connection is certain.

SIMPLE TO INSTALL

ONLY THREE SIMPLE OPERATIONS ON EACH END—THEN THE COMPLETE JOINT

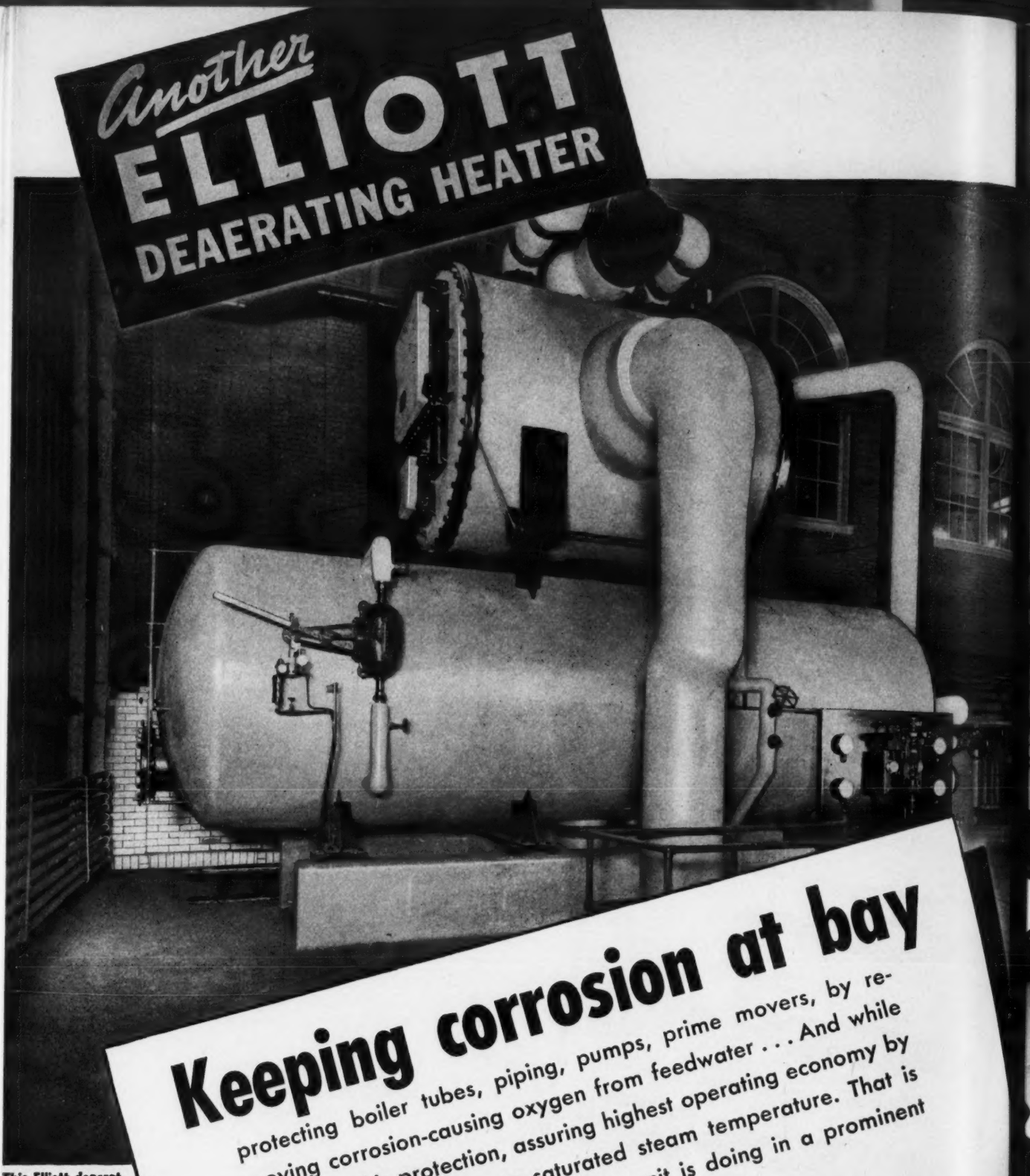


Electroline Company

Originators and Patentees of Automatic Line Splices and Dead Ends

4121 South La Salle Street Chicago, Illinois

Available in complete range of sizes from 300 MCM to 1000 MCM in straight couplings as illustrated. Also made in dead end types. *Write today for complete prices and illustrated literature.*



This Elliott deaerating heater handles 453,100 lb. per hr. feedwater. It is of the horizontal type, mounted on a horizontal storage tank. Elliott builds them in vertical type too, and in a wide range of capacities.

Keeping corrosion at bay

protecting boiler tubes, piping, pumps, prime movers, by removing corrosion-causing oxygen from feedwater . . . And while providing this protection, assuring highest operating economy by heating the feedwater to saturated steam temperature. That is the double-barreled job this Elliott unit is doing in a prominent middle-western utility plant.

ELLIOTT COMPANY

Deaerator and Heater Dept., JEANNETTE, PA.

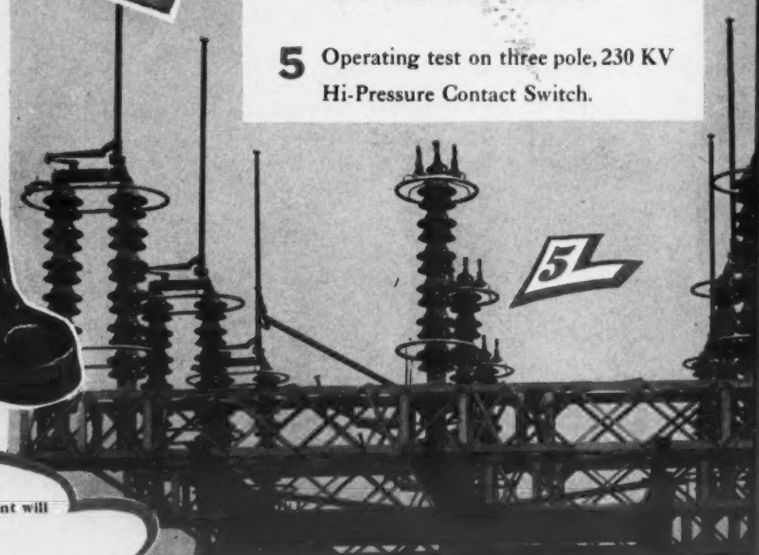
DISTRICT OFFICES IN PRINCIPAL CITIES

N-870A

CHECK THE FACTS on R&IE Products

MECHANICAL TESTING shows the Margin of Quality in equipment. R&IE materials and processes are used only after qualifying under thorough, punishing tests. Tests prove, far beyond actual service conditions, their fitness for finished assembly.

1. An exaggerated bending and twisting test checks materials used in R&IE switch parts.
   Note - No evidence of cracking.
2. Tension test checks strength of R&IE assembly methods. Stressed to 23,400 lbs., joint remained perfect while holes and metal elongated.
3. Actual operating tests check the proper application of flexible connector to outdoor switch - 8571 operations without injury.
4. Cantilever break test on Class B Indoor insulator checks R&IE die-metal hardware construction.
5. Operating test on three pole, 230 KV Hi-Pressure Contact Switch.



We **"CHECK THE FACTS"** *for you.*
You can see today how R&IE equipment will serve well tomorrow.

ENGINEERING AND PRODUCTION
COMPLETE SUBSTATION
OPERATING MECHANISMS
DISCONNECTING SWITCHES
AIR BREAK SWITCH
CONNECTORS
BUS CLAMPS
CUTOUTS
THERMO-RUPTERS
METAL HOUSED, ISOLATED BUS
TESTING FACILITIES
AUTOMATIC THROW-OVER EQUIPMENT
METAL CUBICLES
INTERLOCKS
TESTING DEVICES

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
IN TORONTO, CANADA EASTERN POWER DEVICES, Ltd.

"SEE-ABILITY" adds manpower!

Who says they never come back? There are thousands of older, experienced workmen going back on the job for the duration. The knowledge and ability of these men is needed in our war factories—men who know how to handle machines and equipment, how to get things done.

Improved See-ability through good lighting has made it possible for these older men to put their skill to work. For sharp vision, men in their sixties require more light than men in their twenties.

In placing these men, therefore, it is necessary to check up on the See-ability needed for the work they are to do. In many cases this can be improved by making better use of present lighting equipment, checking reflective values of paint, distance of the lamp, avoiding shadows and glare. Helpful suggestions along these lines are included in a Westinghouse booklet, "See-ability for Indoor Eyes." If you would like a copy, simply write Department I-1, Westinghouse Electric and Mfg. Company, Bloomfield, New Jersey. Your local power company will also be glad to help you get more See-ability from your lighting equipment.

See-ability in our war factories is now improved through better fluorescent lamps. Westinghouse Mazda fluorescent lamps are brighter from end to end, longer lasting, lower in cost, than ever before.

Westinghouse

★ MAZDA LAMPS ★

FOR GREATER SEE-ABILITY

HERE'S A WARTIME INVESTMENT
NEW ELECTRO-COOLER THAT JUMPS
POWER TRANSFORMERS 20-60%..AND

QUICK FACTS

EASILY INSTALLED or removed — *without* shifting the transformer. If the transformer has standard radiator valves, there is no need even to drain oil on installation!

FACTORY SEALED! No pipe connections or joints to be made in the field. ELECTRO-COOLER is factory-assembled as a unit.

NO GLANDS or stuffing boxes! Oil drips and air bubbles are eliminated. Never any need to fix packing.

ONLY ONE SHAFT! Motor and pump are designed as a complete unit — on one shaft and in one frame. Result: greater mechanical strength, fewer parts, fewer mechanical fits.

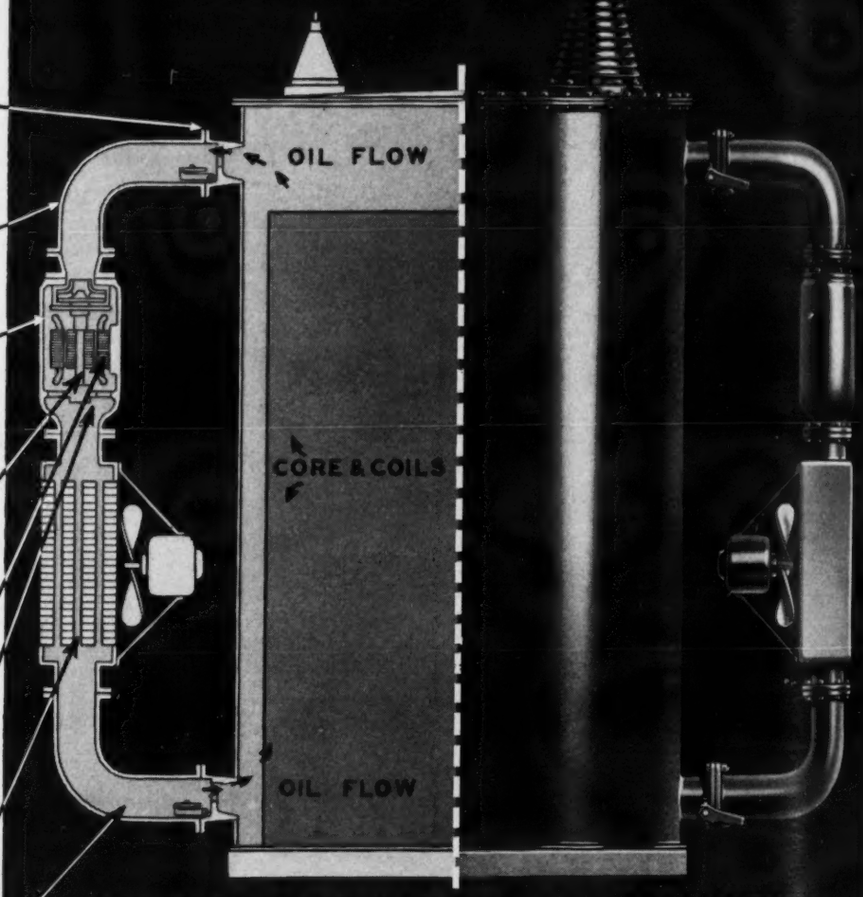
SIMPLICITY! The three-phase squirrel cage motor has no starting brushes, no commutator, nor other such wearing parts to cause trouble.

SELF-LUBRICATED motor and pump are totally enclosed, immersed in oil

HIGH-PRESSURE TESTED! Possibility of oil leaks or seepage is minimized by testing the ELECTRO-COOLER at 50 pounds pressure. Maximum working pressure is only a few pounds.

SELF-CONTAINED and self supporting! The new ELECTRO-COOLER requires no foundations.

New Electro-Cooler



THIS ENTIRELY NEW UNIT SHOULD NOT BE CONFUSED WITH ADAPTATIONS OF AIR-CONDITIONING DEVICES

ALLIS-CHALMERS

WITH A GREAT PEACETIME FUTURE: CAPACITY OF MOST ALLIS-CHALMERS SAVES TIME, TROUBLE, SPACE, COST!

★ New ELECTRO-COOLERS can step up capacity of most transformers now in service by 20 to 60%. Installation is simple!

★ Allis-Chalmers' new ELECTRO-COOLER is self-contained and self-supporting... employs no stuffing boxes. Here's the coming thing in forced-oil cooling...a sound long-term investment!

★ New Transformers built with Allis-Chalmers ELECTRO-COOLERS use 25% less copper and steel...cost less!

IF YOUR power transformers are cooled by slow thermo-syphon flow of insulating liquid through their radiators—and most of them are—chances are that new ELECTRO-COOLERS can sharply increase their capacity!

By accelerating liquid flow with pump action — and by forcing cooling air over radiator surfaces — new ELECTRO-COOLERS step up the capacity of most transformers now in service by 20 to 60%!

Installation of new ELECTRO-COOLERS is simple because the units are self-contained and self-supporting. There's no need to shift transformers.

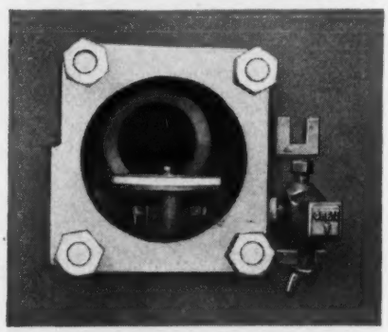
And because the ELECTRO-COOLER is factory-assembled as a unit, there are no pipe connections or joints to be made in the field!

Note that there are no stuffing boxes to require packing — that motor and pump are built on one shaft and in one frame for greater strength and simplicity. Maintenance is *minimum*.

Buying new ELECTRO-COOLERS is smart buying in wartime — and smart buying for the peace years, too. To learn what new ELECTRO-COOLERS can do for *your* system, call the district office near you. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1577

FINAL TESTING of 20,000 kva transformer equipped with new ELECTRO-COOLERS.



NO NEED to drain oil if transformer has this standard radiator valve!

TRANSFORMERS

ALLIS-CHALMERS MILWAUKEE AC — WE WORK FOR VICTORY — WE PLAN FOR PEACE

The familiar Miracle

Look twice. You think you see a negative of two soldiers clashing in bayonet practice. Actually you are looking at sunlight and silver bromide.

The mysterious action of light on certain silver salts is just as much a miracle today as it was a hundred years ago when the first photographs were made.

Hardly less amazing is the remarkable sensitivity of present-day photographic emulsions.

These new films and papers could not be manufactured without exacting control of temperature, control of humidity and protection against dust. *Air conditioning* makes them possible.

Air conditioning and refrigeration play a part in many photographic processes. They are being used to speed up military photography . . . improve all photography.

Today, air conditioning equipment . . . developed by General Electric . . . has been made more compact, more flexible to meet unusual wartime requirements.

After the war, these improvements will result in better air conditioning for offices, stores, theatres, hotels and many other civilian purposes. When the war is won, General Electric will provide this better air conditioning—for a better world.

Air Conditioning and Commercial Refrigeration Department, Division 432, General Electric Co., Bloomfield, New Jersey.

Air Conditioning by **GENERAL ELECTRIC**

Restrictions that make forged steel pins practically un-available today need not hinder the building of necessary lines with pintype insulators. After careful investigation we find that a wood pin, dipped in O-B Conduction Paint, will provide all of the essentials of a steel pin for several years--plenty long enough to get us over the hump today, and cheap enough to make later installation of steel pins still perfectly practical...This wartime measure has the great advantage of involving a very minimum of critical material. There is no intention to imply superiority of wood over steel pins. It has been determined, however, that conduction-dipped wood is a suitable substitute for five or possibly ten years' service...Good design of the insulator is an important factor in the life of the pin. Naturally, tests which confirm the above statements were run with O-B pintypes. With these insulators, we *know* the plan is workable on voltages up to 69 kv. Specifiy O-B and you can have the same assurance.

2415-H

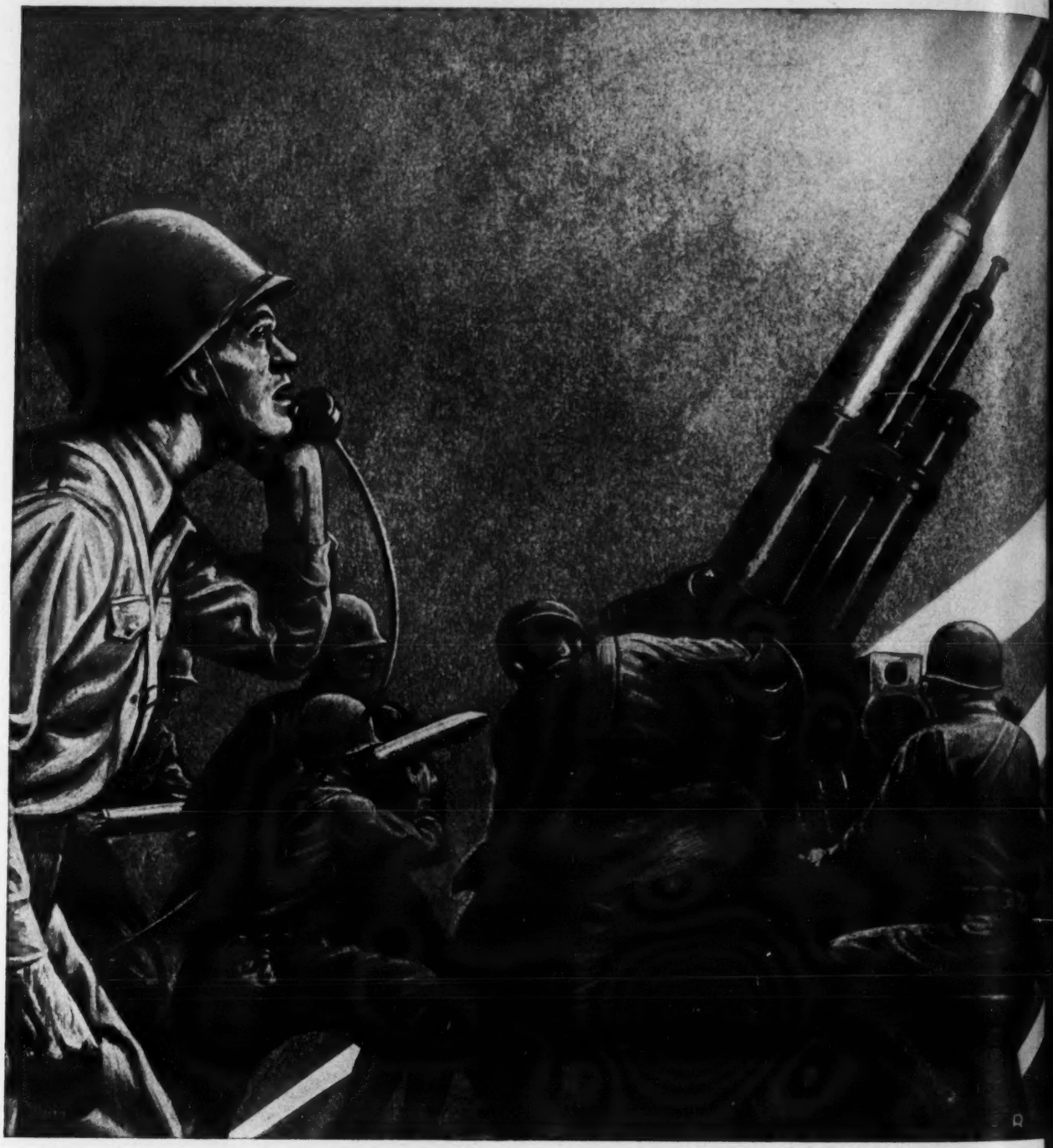
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario

KEEP BUYING WAR BONDS

Every branch of the Armed Services uses the telephone. No. 1 of a series, Anti-Aircraft.



To his mother and dad it seems only yesterday that he was using the family telephone to call hi high school sweetheart. But today the orders he sends and receives over his wartime telephon help speed the day when love and laughter, peace and progress shall again rule the world

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT

HOW TO SOLVE
Operating Problems with Correct Lubrication
THE OIL MUST LUBRICATE AND COOL
DEPOSITS CAN "RAISE CAIN" IN RESTRICTED PASSAGES

Use "Character" Analysis!

PROBLEM: Selecting turbine oil is a major decision. For only an oil film stands between safe operation and possible destruction of the turbine. The oil must maintain a high chemical stability over a long period of service, because deposits resulting from oil oxidation may interfere with free oil flow through the bearing and governing apparatus. This will cause higher operating temperatures, rapid oxidation, even disastrous bearing failure.

ANSWER: The most dependable way to foretell what a turbine oil will do is to analyze its character. *What has it done for others over a long period?* Gargoyle D. T. E.'s are used in over 50% of U. S. A.'s major-sized turbines and have service records of over 120,000 hours in a single turbine. It has been *proved* that their chemical stability assures trouble-free lubrication. These oils are far-and-away your wisest and safest choice.

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.—Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

A BULLS-EYE AT 10,000 FEET

Our anti-aircraft guns blast enemy planes from the sky, at two miles up, and higher. With the making of this complicated and refined weapon, Chromel resistor alloys have something to do. This is one of the good reasons why Chromel is not available as the element for domestic heating devices. But gladly, do we all forego the home comfort and convenience of Chromel, that this useful nickel-chromium alloy may slap the Jap and humble the Hun . . . Meanwhile, the heating devices now in use will last and last, because of their good Chromel elements. For technical data, ask for our new Catalog-M. Hoskins Manufacturing Company, Detroit, Michigan.

Some day soon

YOU'LL BE RIDING ON SYNTHETIC TIRES . . .

In America's new synthetic rubber plants, Westinghouse Control Centers help make synthetic tires faster. They save time in installation . . . provide flexible motor control for future plant expansion.

In the new synthetic rubber industry, more than 80% the motor circuits (over 6500) will be controlled by estinghouse Control Centers.

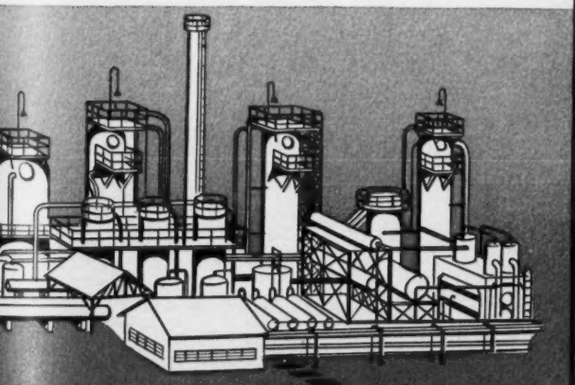
ere's why:

GET PRODUCTION ROLLING SOONER. Westinghouse Control Centers can be installed faster, and put to work almost immediately. Internal buses and wiring troughs simplify wiring.

PROVIDE FLEXIBLE CONTROL. All starter panels are multiples of the smallest size, are interchangeable and can be easily rearranged to meet future needs.

ISOLATE HAZARDS. With Control Centers installed at the dry end of the polymerization process, all motor controls are outside danger areas. This saves critical materials and expense incident to explosion-proof control.

This Westinghouse development is ideal for any plant in need of safety and faster installation *today* . . . and interchangeability for quick conversion to peacetime production *tomorrow*. Get the full story—write for Booklet 3026. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-21261



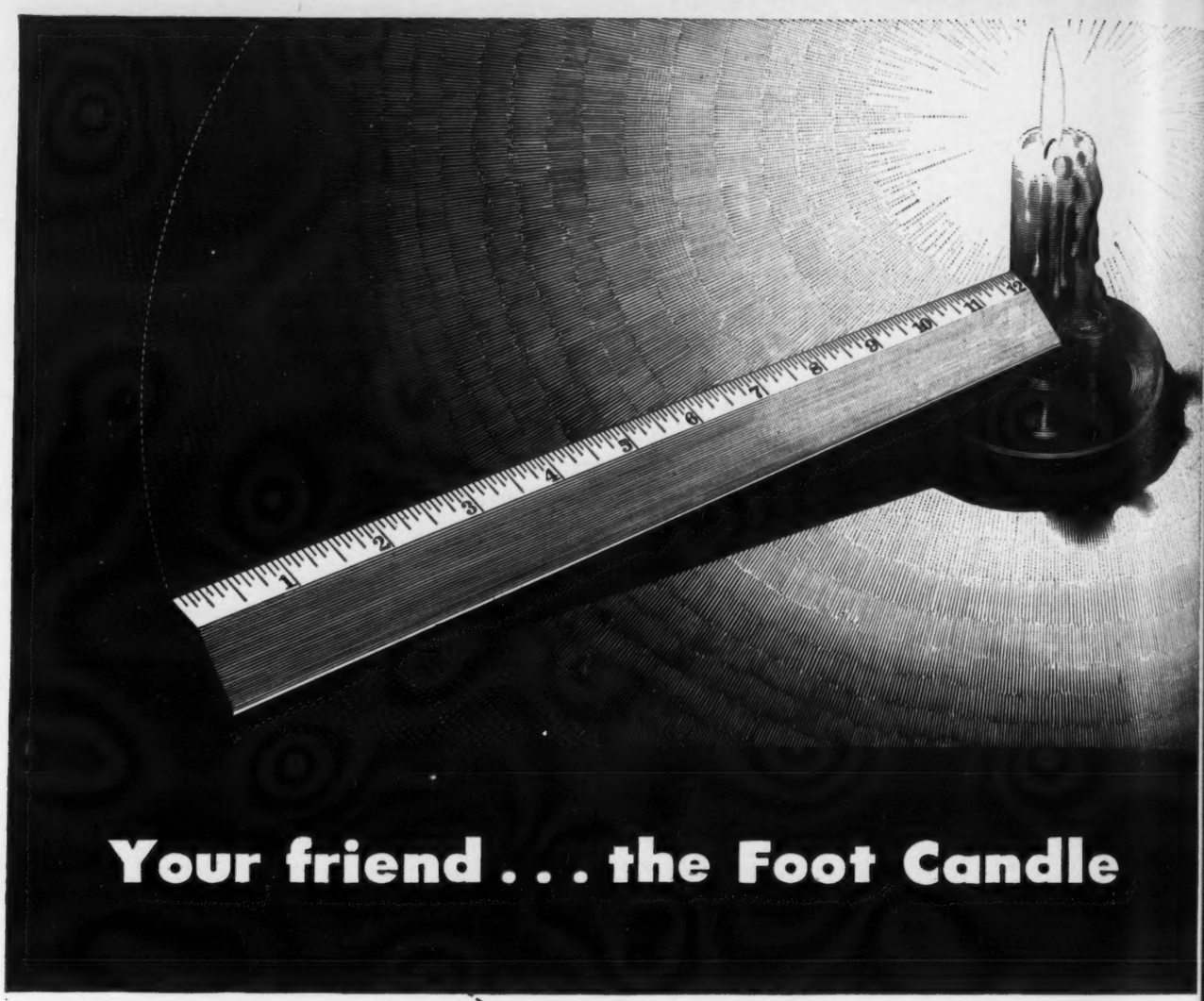
Westinghouse Control Centers isolate motor controls away from hazards...can even be installed in a separate building.

WESTINGHOUSE

Vestinghouse

...TS IN 25 CITIES ...OFFICES EVERYWHERE

MOTORS AND CONTROLS



Your friend . . . the Foot Candle

A foot candle is the illumination from one standard candle on a surface one foot from the light source.

It is the unit of measurement of illumination.

But more than this, the foot candle is man's staunch friend.

In adequate amounts it means his family will have sufficient light in the home . . . he and his fellow workers sufficient light for better, safer factory production or efficient office detail.

For almost 100 years the MILLER organization has known the foot candle on working terms. This lighting experience bridges the broad ground from the whale oil lamp to the modern continuous fluorescent lighting system now helping industry speed out planes and tanks and cannon.

It has involved engineering and design and skill with copper . . . glass . . . steel . . . aluminum and many new non-metallic materials. It has required ingenuity and resourcefulness and pioneering.

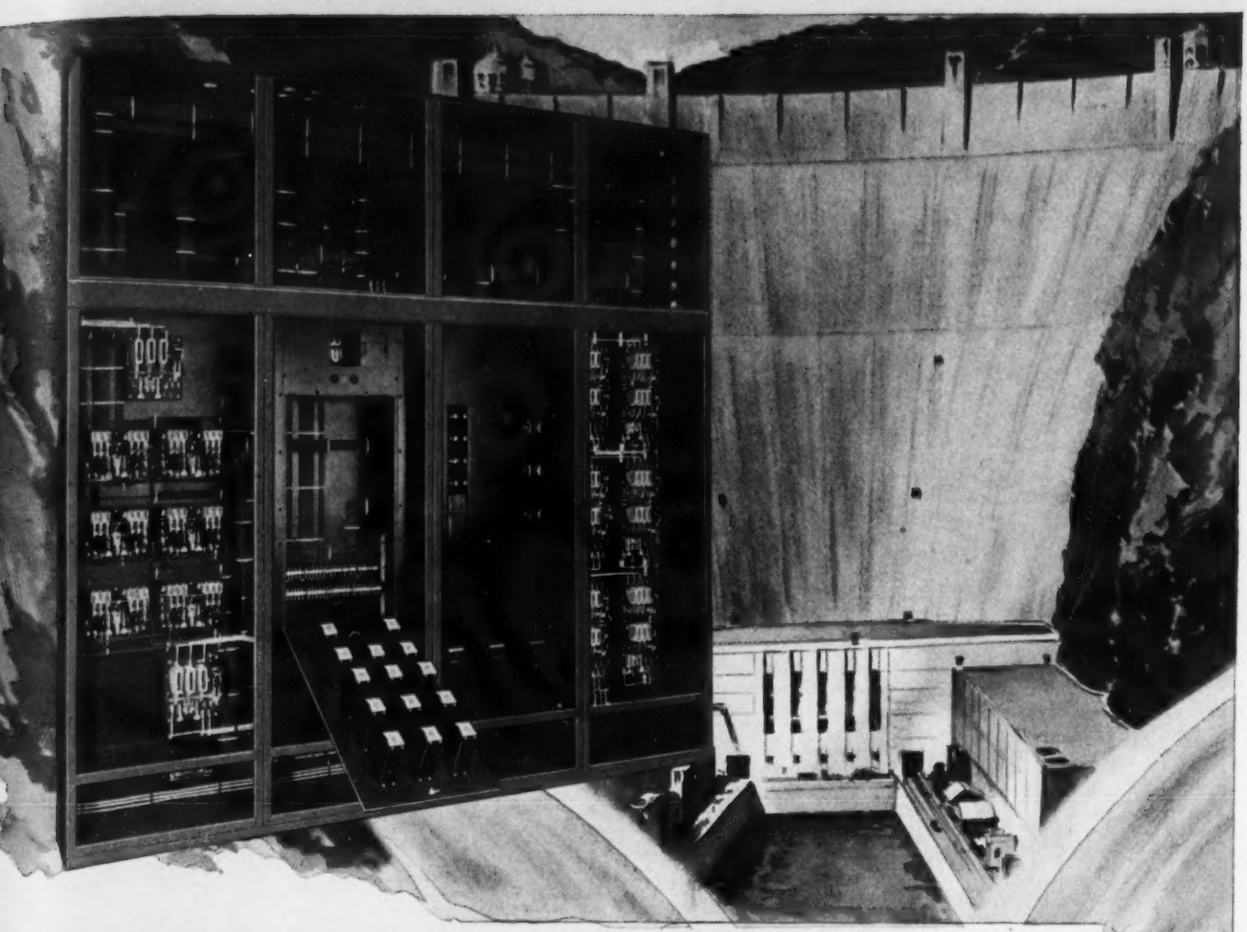
It qualifies us to work with those who need better lighting in war industry. It enables us to cooperate intelligently with those who promote better lighting and sell and service it, too. It means that the MILLER engineer (located in principal cities) can serve you in one of several ways, for better lighting today and tomorrow.

Miller Lighting

. . . for better, safer production
. . . for a more prosperous peace

THE MILLER COMPANY • MERIDEN, CONN.

Today our men and women are also busy making gauges, bomb noses, torpedo and searchlight parts, wiring devices, ship fixtures and many other precision parts for Army & Navy.



WOLFE & MANN
... at BOULDER DAM

ABOVE is the valve and gate control panel, one of 8 electrical installations at Boulder Dam, engineered, designed, and manufactured by Wolfe and Mann of Baltimore. The Wolfe and Mann organization is staffed and equipped to give every contract personal attention and expert engineering skill. Ask the folks at Boulder Dam what they think of the performance and dependability of Wolfe and Mann electrical equipment. Write us about your requirements.

These Projects
ARE OUR REFERENCE

BETHLEHEM STEEL COMPANY
CULPEPER POWER PLANT, CULPEPER, VIRGINIA
NAVY HIGH POWER RADIO STATION, ANNAPOLIS, MD.
UNIVERSITY OF VIRGINIA
WEST VIRGINIA PULP & PAPER CO.
U. S. GOVERNMENT:
BUREAU OF SHIPS
DEPARTMENT OF COMMERCE (LIGHTHOUSE SERVICE)
PANAMA CANAL
PEARL HARBOR, T. H.
U. S. TREASURY BUILDING, WASHINGTON, D. C.

WOLFE & MANN
Manufacturing Company

TRADE MARK REGISTERED

SWITCHGEAR ★ SWITCHBOARDS ★ PANELS
8TH AND SISSON STREETS ★ BALTIMORE, MARYLAND

WHEN THE B-17 GOES UP— MICA is there

When 25 tons of fire-power goes up with hell's fire for the Axis, somewhere in the maze of precision-built machinery—mica is there. *Mica*—because mica insulates permanently and dependably. The B-17 goes up to stay up until its job is done. No place for a substitute. Mica *stays* on the toughest kind of insulating job.

There is nothing more we can say about mica, as a matchless insulating material, that you do not already know. We do say—when you think of mica, think of MACALLEN'S 50 years' specialized skill and experience in processing mica to the greatest possible usefulness. Our engineering department is ready to cooperate with you in your manufacturing plans for the future.

THE MACALLEN COMPANY

16 MACALLEN ST., BOSTON

CHICAGO: 565 W. Washington Blvd. CLEVELAND: 1005 Leader Bldg.

BTC Hardware on 230 Kva.

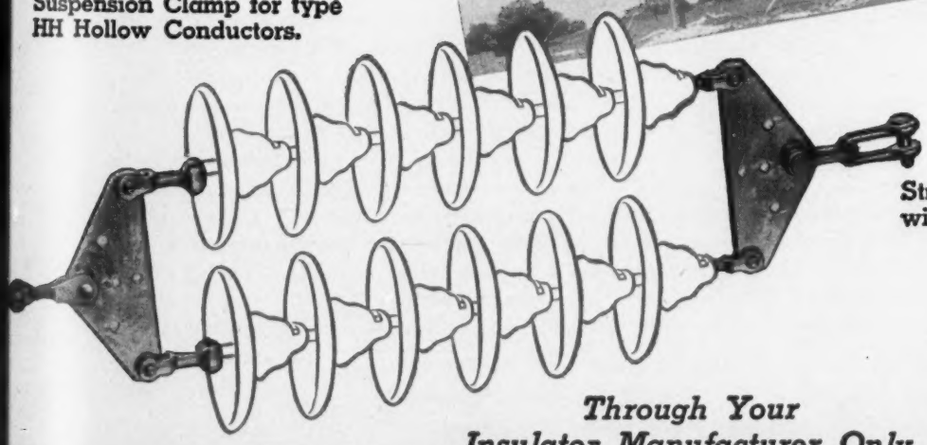
Wood-pole Line

Described elsewhere in this publication is the longest wood-pole line for 230 Kva. operation to be built in the United States. We are proud to say that BTC supplied all suspension clamps and fittings for the three types of 500,000 c.m. expanded diameter copper conductors, all ground wire clamps and all strain yoke sets.

If you are designing a transmission line, call upon BTC. Our years of experience in Hi-Line hardware is at your disposal.

Suspension Clamp for I Beam and Stranded Tubing Core Conductors.

Suspension Clamp for type HH Hollow Conductors.



Strain Yoke Sets with Die-Forged Plates.

Through Your Insulator Manufacturer Only

BTC

The Brewer-Titchener Corporation

Cortland, New York

HERE'S THE BIG DIFFERENCE BETWEEN *PRECIPITRON** AND CONVENTIONAL AIR CLEANERS

It removes the *dirt you don't see*, too... 90% of *all* particles down to 1/250,000 of an inch

For every sizable speck of soot or dirt in the air there are literally thousands of smaller particles entirely invisible to the naked eye. These small particles are elusive fellows—less than 25% being "captured" by conventional air cleaning methods. And they can be a menace, too—particularly in industrial operations where clean air is a prime essential.

Precipitron, because it operates on an entirely different principle, removes 90% of *all* particles including those small as 1/250,000 of an inch. Dust, haze, and even tobacco smoke, disappear as if by magic.

The Precipitron is a simple device with no more moving parts than a storage battery. Hidden away in a ventilating duct, this Westinghouse electric air cleaner operates silently and efficiently. As each particle in the air stream passes through the Precipitron it is given an electric charge and then drawn off to oppositely charged plates. Since there are no filters to become clogged, resistance to air flow is negligible.

Today, Precipitron is enlisted 100% in the country's service. Its job is that of supplying electric air cleaning as an aid in speeding America's war production. For full information, write Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio. *Plants in 25 cities, offices everywhere.*

*Trade-mark registered in U. S. A.

Westinghouse

Precipitron

SAVE METAL

BY USING

ALL PORCELAIN LIDS

ON INDOOR HIGH VOLTAGE POTHEADS

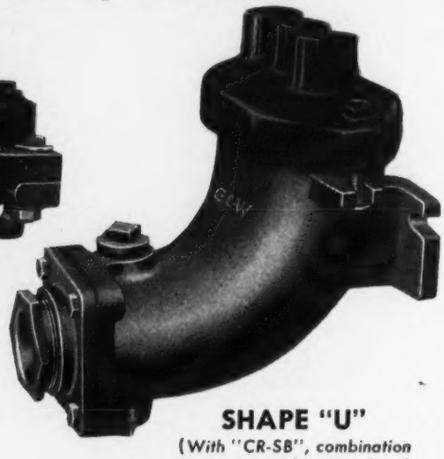
G & W TYPE "P"

The insulated cable conductors are brought out through the three holes in the all-porcelain lid—without using any copper connectors. The lid holes have extensions which permit tape sealing the separate conductors to the porcelain.

SHAPE "C"
(With stuffing box and conduit coupling.)

COMPLETE DATA FOR ORDERING IS GIVEN BELOW

SHAPE "K"
(With wiping sleeve.)



SHAPE "U"
(With "CR-SB", combination clamp ring and stuffing box.)

6600 Volts Indoor—600 Volts Outdoor

Type "P" potheads are made in three shapes. The porcelain lid has three holes of ⅞ in. diameter and will take any sized conductor that will pass through. Two holes have keyways or slots for venting air while filling with compound.
The center hole in lid can be plugged for use with 2-conductor cable.

Max. Dia. Cable		CATALOG NUMBER	LIST PRICE	Body		Approx. Shipping Weight Lbs.	Approx. Comp'd Req'd Gallons
Wiping Sleeve	"CR-SB" or "SB"			Shape	Symbol		
2¼"	1¾"	AP3523C	$12.00	C	P3C	16	¾
3¼"	2⅞"	AP3524C	15.00	C	P4C	20	1
2¼"	1¾"	AP3523K	18.00	K	P3K	25	1
2¼"	1¾"	AP3523U	18.00	U	P3U	25	1

Filling compound not included in above prices. Add 10% list.
Conduit couplings and armor clamps extra—Up to 2½"—$1.50. Up to 4"—$3.00 List.

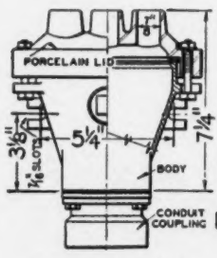


Fig. 87—Shape "C"

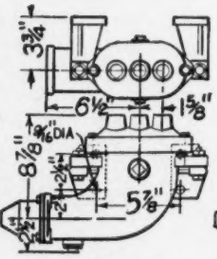


Fig. 88—Shape "K."

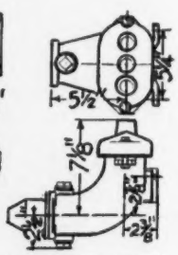
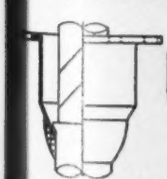
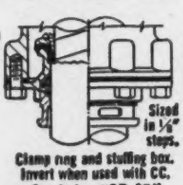


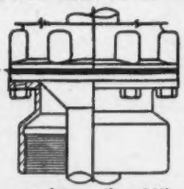
Fig. 89—Shape "U."

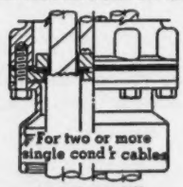
CABLE ENTRANCE FITTINGS IN STANDARD STYLES SHOWN BELOW. SPECIFY STYLE WANTED. BE SURE TO GIVE CABLE DATA AND CONDUIT SIZE.

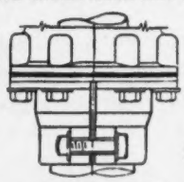

Wiping Sleeve—"WS"

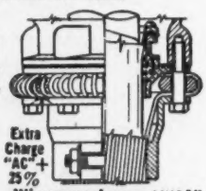

Clamp ring and stuffing box. Invert when used with CC. Sized in ⅛" steps.
Symbol—"CR-SB"

Plain stuffing box. Can be drilled on job to cable size. Uses cord packing.
Symbol—"SB"


Conduit coupling "CC"


For two or more single cond'r cables
Symbol—"PB"


Armor clamp "AC"


Extra Charge "AC" + 25%
Wire armor clamp—"WAC"

Send for Bulletin 392 for complete data on other types of G & W POTHEADS.

G&W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE • CHICAGO, ILLINOIS
In Canada—Powerlite Devices, Ltd., Toronto, Ont.

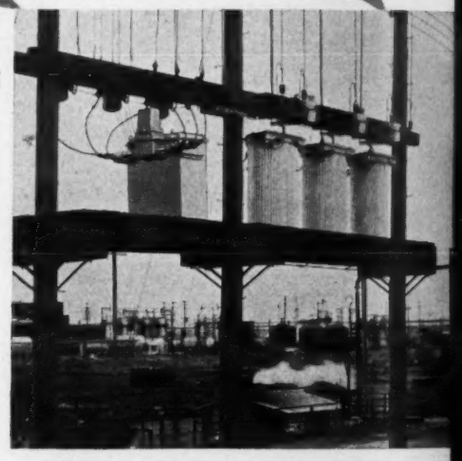
POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

E C & M COMPLETELY ENCLOSED

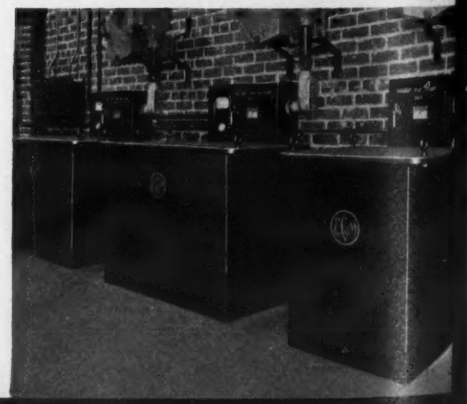
Unit Starter

FOR 2300-VOLT MOTORS

Push button operated from low voltage



For outdoor mounting and indoor operation



THIS highly efficient starter for squirrel-cage or synchronous motors offers five definite advantages:

1—Single, quick-break, double-throw Contactor operated by a single magnet, a throw-over spring and a mechanical latch tripped by a Current Limit Relay to cause transition from reduced voltage to full voltage running.

2—Continuous Torque during transition from reduced to full voltage.

3—Self-contained Potential Transformer for 220-volt push button circuit with enclosed fuses also in this circuit.

4—Adjustable, magnetic type, two-coil, non-creeping Overload Relays with Inverse Time Element Feature for protecting motors from overheating due to overloads or loss of one phase. Arranged for Magnetic Reset.

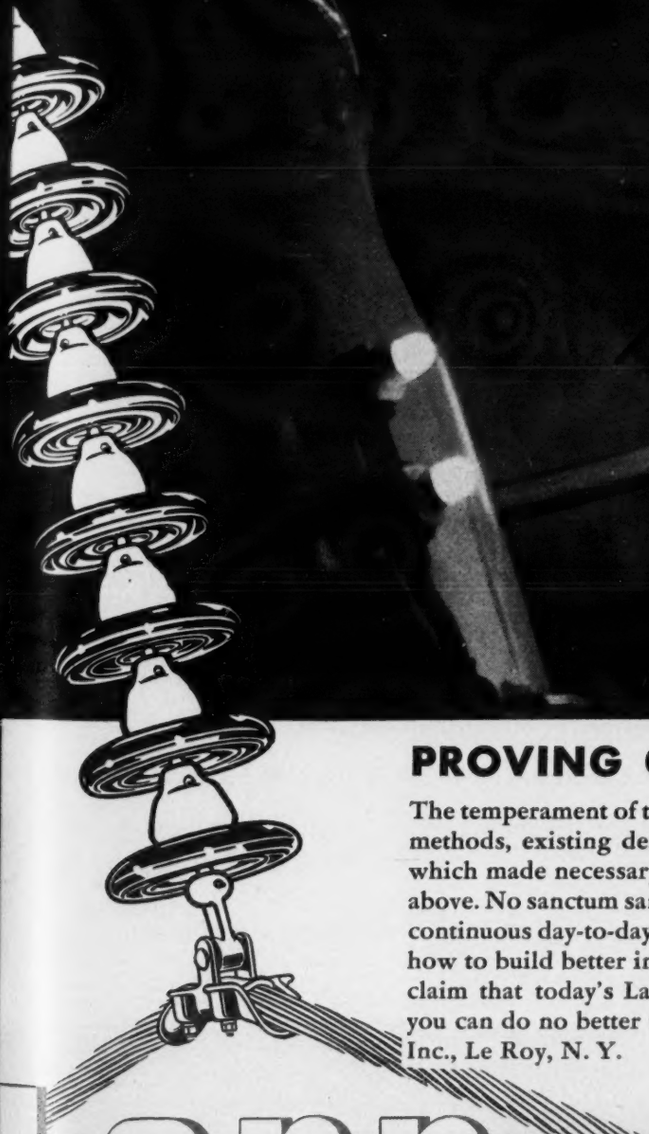
5—NEMA Type II (Drip-tight) Enclosure for floor mounting with compensator-mechanism completely oil-immersed.

Arranged for Low Voltage Protection or Low Voltage Release as specified. Ask for Bulletin 1047-C.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND OHIO

T'S THE *PORCELAIN* THAT INSULATES



PROVING GROUND FOR INSULATORS . .

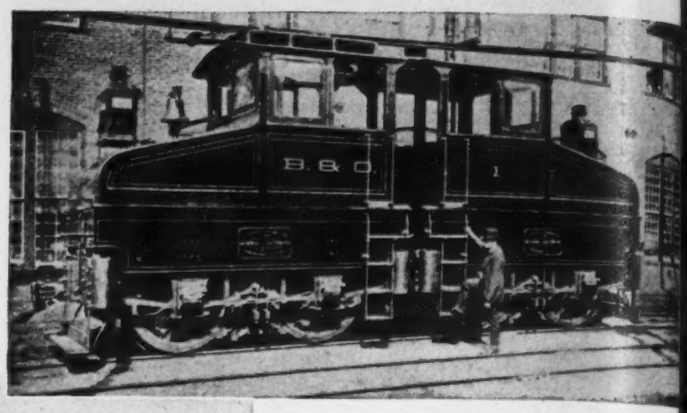
The temperament of the Lapp organization is that of dissatisfaction with existing methods, existing designs. It is this spirit which produced the Line Post and which made necessary the Lapp laboratory, a corner of which is photographed above. No sanctum sanctorum, this laboratory is truly an engineers' workshop, in continuous day-to-day use, testing, discarding, proving new designs. As we learn how to build better insulators, we build them. Meanwhile, we feel secure in our claim that today's Lapp insulators are adequately suited to today's needs, that you can do no better than to insulate your lines with Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.

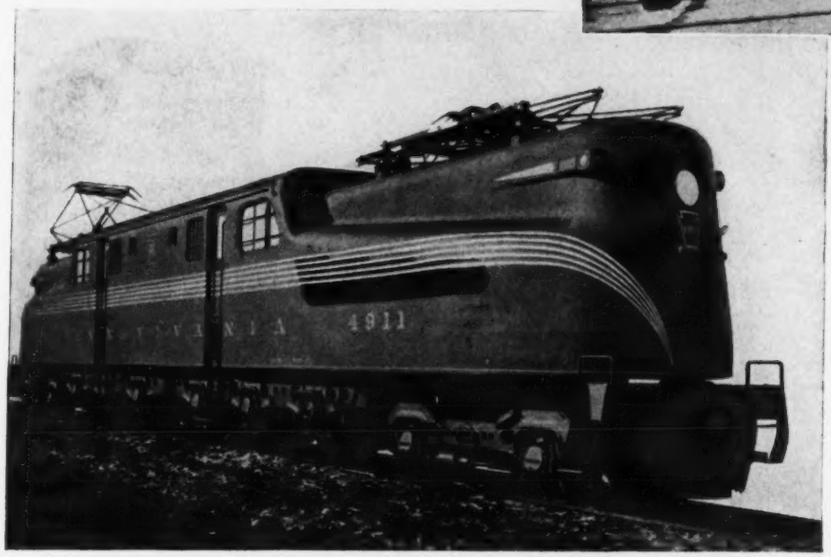
ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

C-D Gave Electric Locomotives the Highball 48 Years Ago





WHEN the husky little electric switch engine first started shoving B & O freight around in 1895 Continental-Diamond was producing the kind of insulation that made such a revolutionary locomotive possible.

P. R. R. No. 4911 gives ample evidence of how far America's Electrical and Design Engineers have advanced these prime movers in both appearance and performance . . . Continental-Diamond, pioneering side by side with the men who planned and built them, has always been ready with an insulating material to meet increasingly severe requirements and provide longer useful life.

The electric locomotive of tomorrow may still be on the drawing boards and likewise C-D Research Laboratories are developing materials that may anticipate the problems involved.

Our Engineers will be pleased to work with you, without obligation.

Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

Don't Worry

ABOUT THE BAN ON OVERSIZE MOTORS

Copperspun

You don't need oversize anyway when you use F-M Copperspun Motors

The fact that W.P.B. restrictions prohibit the purchase of extra size in a motor is nothing to worry about. Fact is, this restriction will conserve critical materials and *save you money*—because, with Fairbanks-Morse Motors with *Copperspun* Rotors on the job, you don't need extra size or extra horsepower to protect the motor in tough service. You can run F-M Motors with Copperspun Rotors under full load *indefinitely* without danger of damage, because these motors depend on extra quality rather than extra size for their stamina.

The winding of the *Copperspun* Rotor is *centrifugally* cast, in *one piece,* and of *pure COPPER.* Copper has better thermal characteristics. Copper has better electrical characteristics. No other rotor winding is cast of *COPPER.*

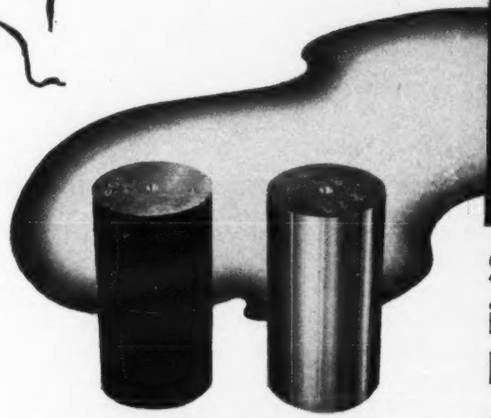
Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago. Branches with service stations throughout the U. S. and Canada.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

Motors

The Scalpers OF TODAY



BEFORE AND AFTER SCALPING

SCALPING AT WOLVERINE is a very important procedure. Every brass block—before it is made into a condenser tube—has its skin taken off—so it can be inspected

To make sure that Wolverine Condenser Tubes are perfect, we make sure first that the block that goes to make the condenser tube is perfect.

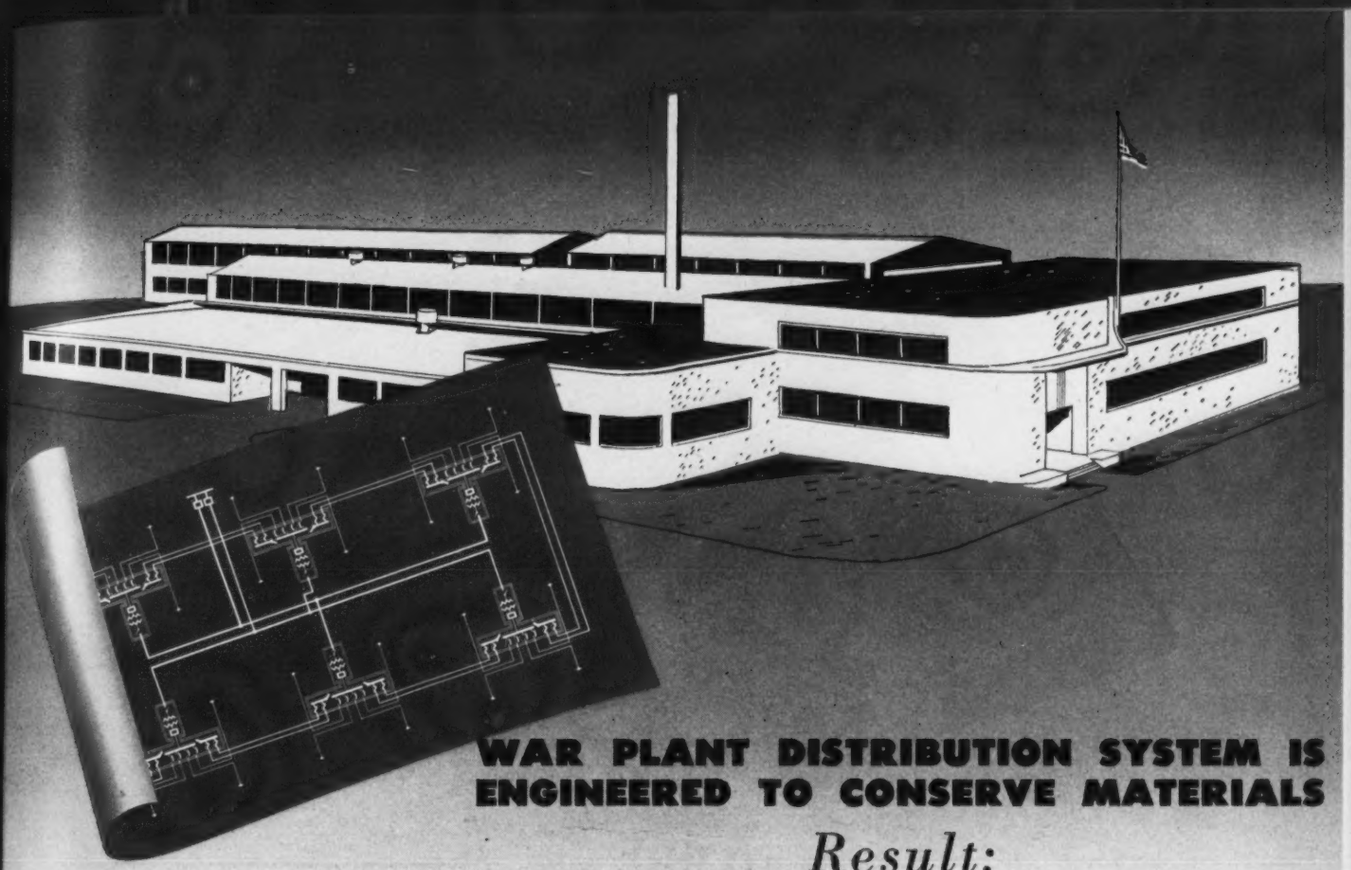
Even in the best casting practice, there may be flaws concealed underneath the outside surface. As each billet comes from the furnace, it is cut up into blocks, and each one is put on a lathe to have the outside surface shaved off. This enables us to make a careful inspection to make certain that no imperfections are allowed to go into the extruder and finally into the finished tube.

With such close inspection of every block and with this process which compels such inspection (and does not merely assume that any imperfections will be removed by subsequent operations), the invariable result is a much more uniform, high quality condenser tube.

Uniform quality is further assured because condenser tubes, like all other Wolverine products, are controlled from ore through to finished product.

ALLOYS FOR THE ALLIES

WOLVERINE TUBE DIVISION
OF CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
Seamless COPPER • BRASS
1427 CENTRAL AVENUE • DETROIT, MICHIGAN



WAR PLANT DISTRIBUTION SYSTEM IS ENGINEERED TO CONSERVE MATERIALS

Result:

6400 pounds of Copper saved

HOW WESTINGHOUSE CAN HELP YOU SAVE TIME AND CRITICAL MATERIALS

- **Selecting the Right System**—Wide application experience in all types of industries enables Westinghouse engineers to recommend the system best fitted to your plant.
- **Air-Cooled Transformers**—permit location close to load centers with maximum safety, eliminate expensive vaults.
- **Hipersil**—an exclusive Westinghouse development with ⅓ more flux-carrying capacity than ordinary silicon steel. Reduces transformer size and weight.
- **Loading by Copper Temperature**—permits use of *all* the transformer capacity, with complete protection against burnouts.
- **Improving Power Factor**—through use of capacitors, can often save installation of new feeder lines. Westinghouse engineers are in a position to make such practical recommendations.

A New England war plant planned to install a distribution system requiring 44,200 pounds of copper. Westinghouse engineers recommended a more flexible, better-protected system using 6400 pounds less copper.

Savings like this prove that "custom-fitting" the distribution system to the job helps to conserve critical materials.

There is no one universal distribution system suited to all plants or all industries. That's why Westinghouse plans and builds *all* types. The one that will best fit your plant is the one that takes full account of the nature, density, and location of load—with the least use of critical materials.

Any system recommended is designed to use standard distribution equipment. No time is lost in building special apparatus.

If you want fast action, call our local office. Or send for the helpful booklet shown below. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

J-94539

QUICK FACTS ABOUT PLANT DISTRIBUTION SYSTEMS

Keep up to date on latest plant distribution systems. Send for Booklet B-3152 which briefly describes different plant distribution systems, and points out the advantages of each.

Westinghouse PLANT DISTRIBUTION SYSTEMS

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

"Tomorrow may be too late—do it today!"...CHECK UP!

THIS

ELECTRICAL FAILURE HALTS WAR PRODUCTION

MIGHT HAVE PREVENTED

THIS

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them... with charts to enable quick periodic check-ups.

NOTE: Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

Company .....

Address ..... City .....

2L

1943

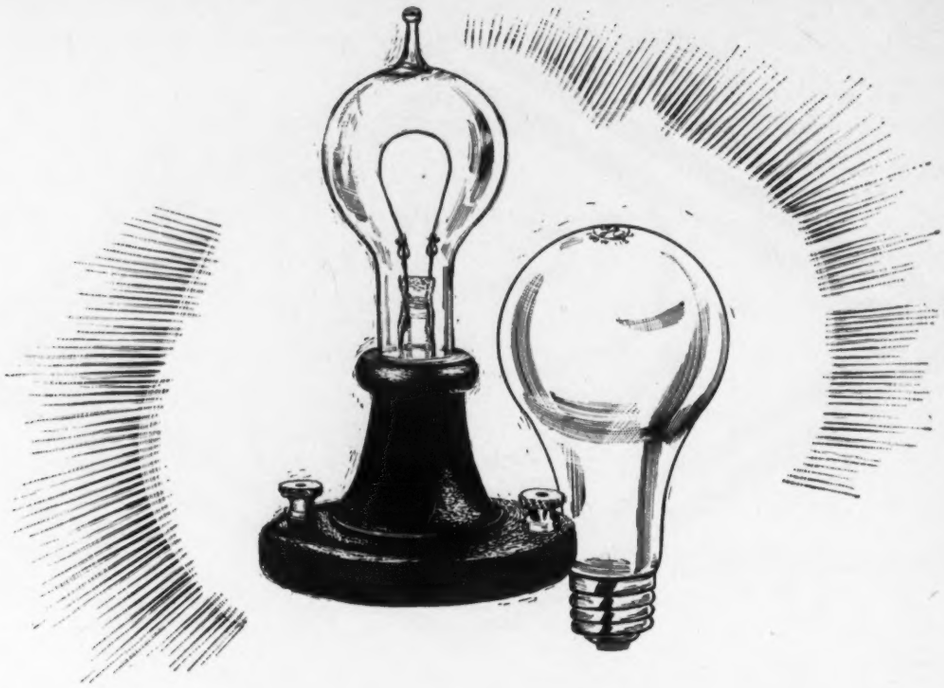
FIFTY YEARS

devoted exclusively to the design and manufacture of electrical equipment for circuit protection

★ SHAWMUT IS THE WORD FOR FUSES ★

The Chase-Shawmut Company
Newburyport, Massachusetts

1893



From His Genius...

FEBRUARY eleventh marks the birthday of Thomas Alva Edison, inventor of the first practical incandescent lamp.

Edison, the newsboy who was cuffed off a railroad train for experimenting with chemicals in the baggage car, became the world's foremost inventor of useful things. Whenever you switch on a light, or see a motion picture, or listen to the phonograph, or enjoy any one of scores of devices that are freeing men and women from drudgery, you owe a debt to Edison.

From his genius vast industries have risen, millions of workers have found employment, all nations are enriched.

Edison was a man of peace. But with all his soul he believed in his country and the preservation of her liberties. He lived to see his incandescent lamp help to win one world war. Now again it is working on all fronts, helping to win another war.

More than 400 different types of G-E Mazda lamps are being produced for military uses. A four-motored bomber requires over 100 lamps of different kinds. Where a searchlight stabs the sky . . . where there are warships or submarines or trains or trucks or tanks . . . wherever factories are working through the night to arm our fighting men, there shines the lamp that Edison gave the world—a symbol of the light of Liberty that can never be blacked out.

G-E MAZDA LAMPS

GENERAL ELECTRIC

MAZDA . . . NOT THE NAME OF A THING BUT THE MARK OF A RESEARCH SERVICE

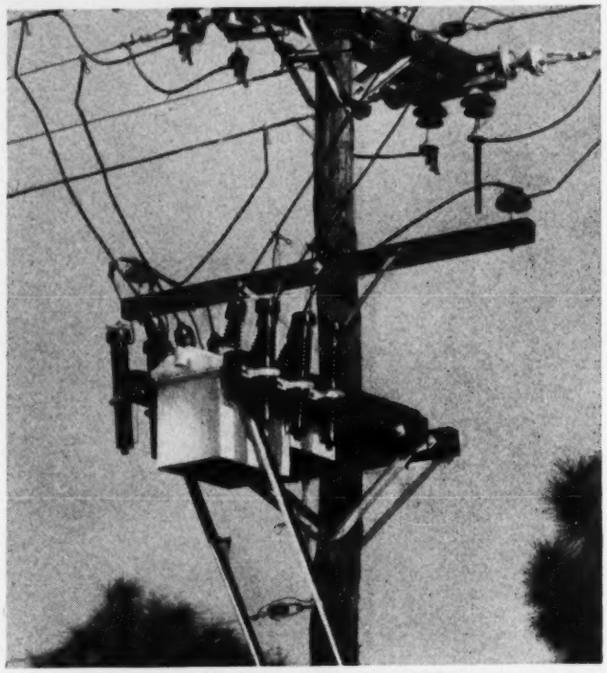
Engineers' "QUIZ" on clearing ANY NUMBER OF TRANSIENT FAULTS

with PACIFIC ELECTRIC'S Motor-Wound

AUTOMATIC

SERVICE RESTORER

Type **AP-40, 100-amps. continuous; 1800-amps. interrupting rating; 15-kv.**



DOES IT DO ALL OF THIS:

1. Restore service immediately after *any number* of transient faults because of its automatic electric rewind of operating spring between operations?
2. Promote great continuity of service to important defense areas through positive reliability?
3. Assure three reclosures at all times with its strong prewound spring and lockout on the fourth opening, giving full protection on sustained faults?
4. Offer easy *outside* adjustments of current and inverse-time-delay trip-mechanism?
5. Assure low upkeep because of fast arc extinguishment by its arc expulsion chambers, permitting high reclosing speed, saving on oil and offer also outside manual operation plus utmost safety?
6. Provide choice of reclosing intervals?
7. Operate 242 times in 8 days during one sleet storm (as one user reports) without lockout?
8. Prove that fuse protection is inadequate for important loads?
9. Offer special accessories, remote electrical control and isolation of faults?

Again, does it do all of this and More, too?

It Certainly Does

—and you can get the full details on Pacific Electric's Motor-Wound Automatic Service Restorer which clears any number of transient faults.

C. H. Cutter 1015 Securities Bldg. Seattle, Wash.	G. B. Kirkwood 437 S. Hill St. Los Angeles, Calif.	U. N. Halliday 230 U. S. Nat'l. Bank Bldg. Denver, Colo.
J. E. Redmond Co. 448 W. Madison St. Phoenix, Ariz.	C. C. Musgrove 508 Insurance Bldg. Dallas, Texas	Filbert & Fredericks 90 West St. New York, N. Y.

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, CALIF. DUNES HIGHWAY, GARY, INDIANA

KERITE
The careful investor judges a security by the history of its performance.
KERITE
in over three-quarters of a century of continuous production, has established a record of performance that is unequalled in the history of insulated wires and cables.
Kerite is a seasoned security.
DAYS KERITE
DAYS KERITE
THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

Mining—Number One War Industry

The mineral products of the earth are the prime necessities of war... and peace

THE SURFACE of the earth provided primitive man with the things he needed for his meager existence but civilization really began when he became curious about its interior. This curiosity has brought us a long way. For the earth has yielded—out of its deep recesses—all the raw materials of modern industry. And today, in the grueling race of production, our mining industry is providing the raw materials upon which depends our survival. Our mines and quarries must supply a long list of materials without which a successful war cannot be fought.

Take steel, for example. War without steel is inconceivable. Steel starts with iron ore, limestone and coke. These are products of mines and quarries. It takes power and heat to get these materials out of the ground, to refine them and to transport them to the point where processing begins. All the subsequent operations culminating in the steel ingot, shape or plate, and in moving the final product to the point of use require power and heat.

The major source of this power and heat is coal.

Production of a ton of steel, it has been stated, requires two tons of coal. Smelting of the pig iron alone, 60,000,000 tons in 1942, required the coking of some 75,000,000 tons of coal. Pig output is expected to rise to 68,000,000-70,000,000 tons in 1943, carrying coal consumption up to 85,000,000 tons. At the same time, output of steel ingots is expected to rise from 87,000,000 to 97,000,000 tons. Think what this means in terms of power and heat.

Another vital metal is copper. Modern armies need copper. This point is dramatically illustrated in a recent memorandum by Robert P. Patterson, Under Secretary of War, in announcing the release of 4,000 men from military service to return to the mines and increase copper production. "In a single minute of combat", Mr. Patterson declared, "a flight of 50 fighter planes shoots away 7 tons of copper. A 37-mm. anti-aircraft gun uses up a ton of copper every twenty minutes it is in operation. Six hundred pounds of copper go into every medium tank, and a ton into the engines and airframe of a Flying Fortress. The Signal Corps alone needs 5,000 tons of copper every month for radio and telegraphic and telephonic equipment. An army without copper would be an army without speed, maneuverability or firepower. It would not last a day in battle".

Seven tons of copper for one minute of combat by 50 fighter planes means from 200 to 700 tons of ore, depending upon its grade. Small wonder that the War Department was willing to release drafted miners from military duties to produce more copper.

But other metals are equally important in war: tungsten, nickel, manganese, chromium, vanadium and molybdenum for alloy steels; zinc for brass and die castings; tin for bronze and bearings; aluminum and magnesium for aircraft; lead and mercury for ammunition; silver for electrical equipment, bearings and solder, and so on. Even relatively insignificant non-metallics, like mica and diamonds, suddenly assume critical importance.

And let us not lose sight of the fact that without adequate energy, i.e., heat and power, production, processing, transportation and the relative comforts to which we have become accustomed would be impossible under war conditions. Coal is the major source of energy in the United States. It supplies more than half the total in normal years.

The railroads of the country alone used 110,000,000 tons in 1942 to move freight and passengers and service their facilities. Utilities consumed over 68,000,000 tons in the production of electric power. Over 135,000,000 tons of coal were consumed last year in maintaining the level of heating comfort necessary for the maintenance of efficiency and morale. The consumption, this year, will be even greater.

In short, the mineral products of the earth are the prime necessities of war.

The nations that control the world's mineral resources and make the most efficient use of them will win the victory.

Before the war, the British Empire and the United States together controlled probably 75 per cent of the world's mineral production. This would have been a most potent weapon in the United Nations' arsenal if the whole strategy of Axis expansion had not been influenced by mineral objectives. Addressing the American Zinc Institute on the subject last April, E. W. Pehrson, of the U. S. Bureau of Mines, estimated that the Axis had improved its position in world mineral resources in the following percentages: iron ore, from 6 to 46; steel production capacity, 20 to 34; petroleum, 1 to 7; coal, 27 to 53; copper, 5 to 10; lead, 7 to 22; zinc, 16 to 27; tin, 1 to 72; manganese, 2 to 30; chrome, 3 to 30; tungsten, 6 to 60. In the light metals, areas now Axis-controlled produced in 1940 54 per cent of the world's aluminum, 49 per cent of the bauxite (the principal source of aluminum) and two-thirds of the magnesium.

Despite these gains, the industrial war power of the United Nations still can outweigh that of the Axis by a considerable margin. It already has begun to surpass it. The problem is to convert quickly our potential mineral resources into implements of war. In this conversion, a heavy burden of responsibility has been placed on the mining industry of the United States as the largest producer of many metals, minerals and fuels. In fact, the United States mining industry began to go on a war basis a year before Pearl Harbor. The curves of demand for domestic copper, lead, zinc and other metals began to rise sharply in 1940, and were paralleled by a rising coal production.

How well the job has been done cannot be revealed in accurate figures in many cases because of censorship. In metals, however, some idea of production gains can be indicated in comparative terms. United States copper production, for example, is breaking all previous records. Aluminum capacity will be more than seven times its annual peace-time average. Magnesium plants now building will have a capacity 100 times the largest yearly before-the-war figure. Molybdenum, of which the United States has the largest single mine in the world, is being made available in record quantity. Zinc, lead and mercury are surpassing expectations in meeting wartime demands, and tungsten, chromium, manganese, antimony and iron and steel are being turned out in record-breaking quantities.

Bituminous coal production in 1942 was 580,000,000 tons, the greatest in history, valued at more than $1,300,000,000 at the mine. Some 430,000 or more men were employed in 1942 and received at least $750,000,000 in wages. Bituminous production in 1939 was 394,855,000 tons, while the output for 1943 is forecast at approximately 600,000,000 tons — another new United States record. The 1942 anthracite output was 59,961,000 tons, valued at over $270,000,000 at the mine. The industry employed some 85,000 men and paid out at least $180,000,000 in wages. The 1939 production of anthracite was 51,487,000 tons, and the forecast for 1943 is 65,000,000 tons or more.

This is the eighth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Marshalling the Western Hemisphere's mineral resources, the United Nations have been the beneficiaries of the diversified resources of two continents — in particular of Canada's nickel and coal, Mexico's lead and antimony, Chile's copper, Bolivia's tin, Peru's vanadium, Brazil's iron, and Venezuela's petroleum. With other United Nations contributing their share of metals and fuel, the grand total is an impressive array of potential munitions and materiel to lend assurance of certain victory over the Axis. Sheer weight of metal, properly used, will win the war, and our mineral industry will have played an indispensable and essential part in the inevitable outcome.

President, McGraw-Hill Publishing Company, Inc.

The Untold Tale

At the recent co-op convention in St. Louis one of the speakers stated that if it hadn't been for the construction of certain government hydro projects we wouldn't have had enough power to make the materials necessary to wage this war.

This isn't the time to engage in a debate as to who did what to win the war. This isn't the time to discuss the merits of one kind of ownership against the other. This is the time, however, for the entire power industry—the combined public and private—to tell the American people what power has done for America and our allies in the war.

The American railroads have done a splendid job, but trains are delayed, breakdowns are more frequent, and it is more and more difficult to get a reservation. Nevertheless, the public knows that to the railroads should go a great big orchid.

Long-distance telephone calls are on priority. There are long waits once more. We are asked not to use the telephone except where necessary. The public, however, knows that the telephone people are doing a big war job and doing it well.

Other industries could be cited that have not been able to maintain their customary service because of the war, but by going to the public have received not brickbats for their failures but praises for their war efforts.

The one important war material industry, however, that has done the best job of all, because it has taken every load and supplied it without delay, continuously and without rationing any of the normal civilian customers, hasn't told a soul. There isn't an industry in the whole United States that can tell as thrilling a story as the power producers, but nobody knows anything about it.

Why has the power industry held back? We suspect that it is pretty much the Milquetoast attitude that has pervaded the industry for the past two-and-a-half presidential administrations.

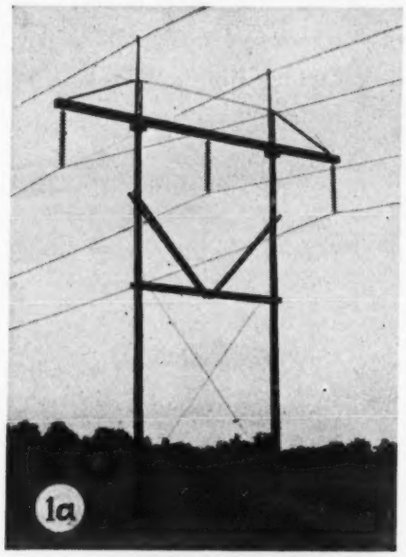
There is only one story to tell the American people at this time, and that is what we, both singly and as an industry, are doing to help win the war. The public relations story that is good in peacetime is out of place in wartime. People today like the music of marching feet, the staccato of the machine gun, the roar of bombs bursting. The power industry has the words, but nobody has set them to music.

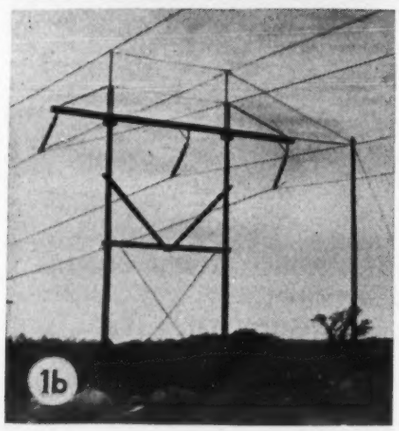
Ordinarily the public is not greatly interested in what industry is doing. High-powered campaigns are ordinarily needed to make any dent at all. Today, however, the public wants to know. It is eager to be told. It is weighing all industry by what it is contributing to the war effort. Will the power industry take advantage of the opportunity—or won't it? Today's public opinion will be tomorrow's public judgment.

Wood Structures for 230-Kv. Transmission

Line for 230-kv. operation supported on wood structures conserves steel and sets pattern for competitive economics

O. S. CLARK,* U. S. Engineers Office, Cooperstown, N. Y.





DESIGNS for two parallel single-circuit, 230-kv. transmission lines to supply power to an important industrial area had been completed early in 1942 and materials were about to be ordered when restrictions regarding the use of steel became effective. Subsequently, the project was redesigned for wood-pole construction, and the entire project, consisting of 158 miles of single-circuit, 230-kv. line, was completed and placed in operation 5½ months later.

These lines are the longest wood-pole lines built in the United States for 230-kv. operation and the only ones for which wood has been used for all structures and all types of structures.

Suspension insulator strings of fifteen 5¾-in. units were provided. Hollow copper conductors of 500,000-cir.mil cross-section, 1.1 in. diameter, were used. Two overhead ground wires, each consisting of three No. 5 extra high strength copper-covered steel strands, were located so as to provide 30 deg. angles of protection for each conductor.

Poles 60 ft. in length were obtained and were made to serve the purposes of the required 65-ft. poles by installing latticed steel channel extensions on the tops of each of the poles of the two-pole structures.

*Resident Engineer.

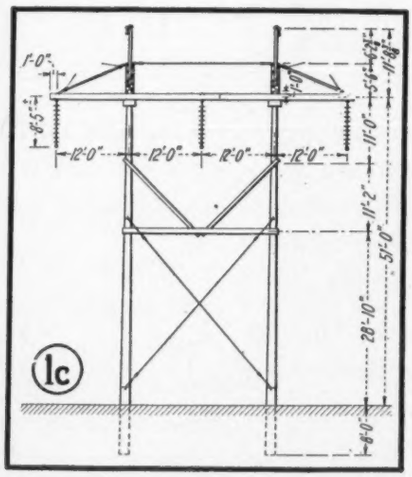


FIG. 1—Tangent structure, an H-frame, uses 60-ft. poles at 24-ft. separation with 12-ft. steel bayonet extension for ground wires

(a) Conventional structure has K-brace of 3x10 in. timbers and 3x6-in. diagonals supplemented by X-brace of two ½-in. Siemens-Martin strands; structure suitable for line angles up to 3 deg. (b) Point of minimum strength at upper point of K-brace connection to pole and guying below this point is ineffective; guying for slight angles accomplished by stub pole with wood-strain in the horizontal guy from crossarm to maintain insulation level of the line. Ground wire bayonets similarly guyed. (c) 50-ft. crossarms are 28- and 22-ft. lengths of 3x12-in. timbers spliced at middle by bolting in a 10-ft. block of 7¼ x 12-in. timber, with similar 4-ft. spacers at ends to enhance strength in line direction.

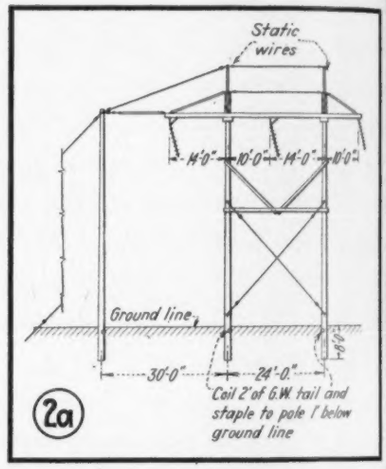
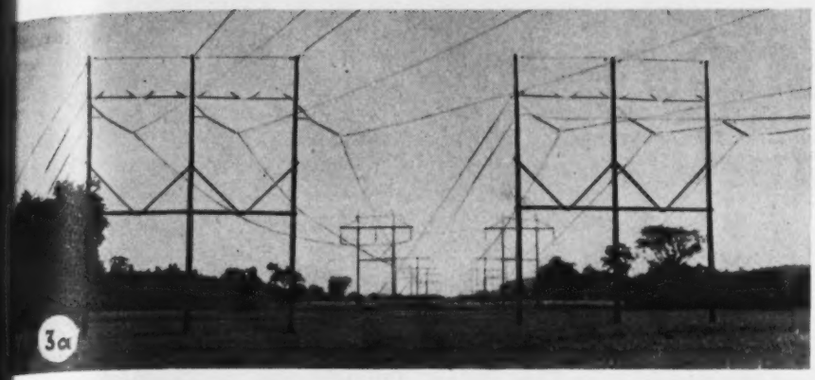


FIG. 2—Angles up to 8 deg. taken on Type B structure

(a) Has crossarm offset 2 ft. with angle brackets added to provide ample conductor clearances. (b) Except in rugged and hilly sections, these H-frame structures were raised in position by means of AD-5 crane and RD8 "Caterpillar" tractor after assembly on ground.



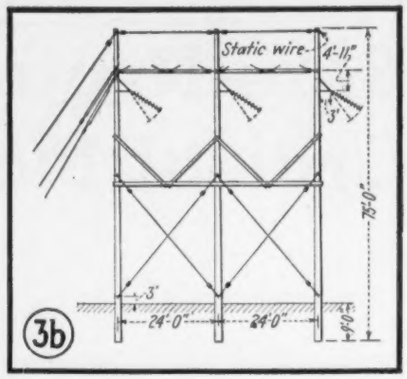


FIG. 3—Braced and guyed angle structure (Type C) used for angles between 8 and 25 deg.

(a) Conventional in pattern but enlarged for the greater spacing requirements of 230 kv. (b) 12,000-lb. wood strain insulators as tension members to transmit overturning stresses from tops of unguyed poles to guys.

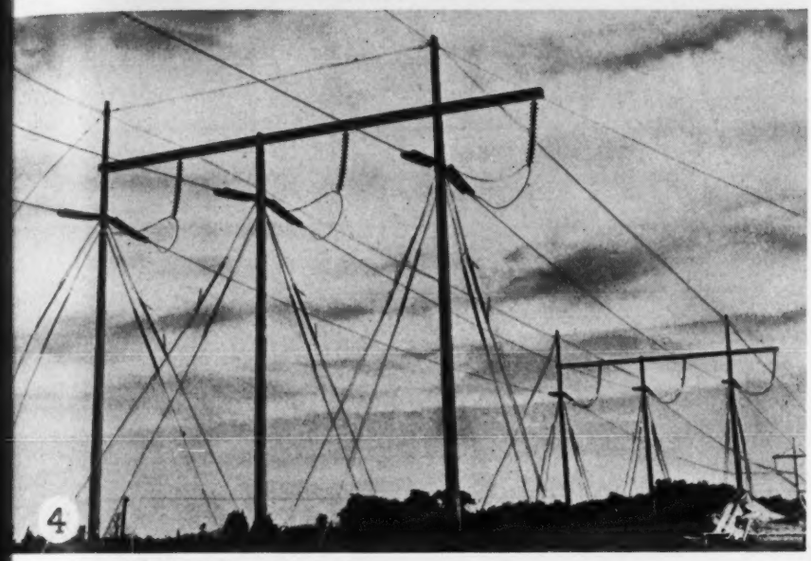


FIG. 4—Dead-end structure used for long spans and where angles exceed 25 deg.

All tangent poles were double-guyed in each direction; to maintain clearances between conductors and overhead-ground-wire guys, the guys were installed in vertical planes displaced 45 degrees from the vertical plane of the conductors.

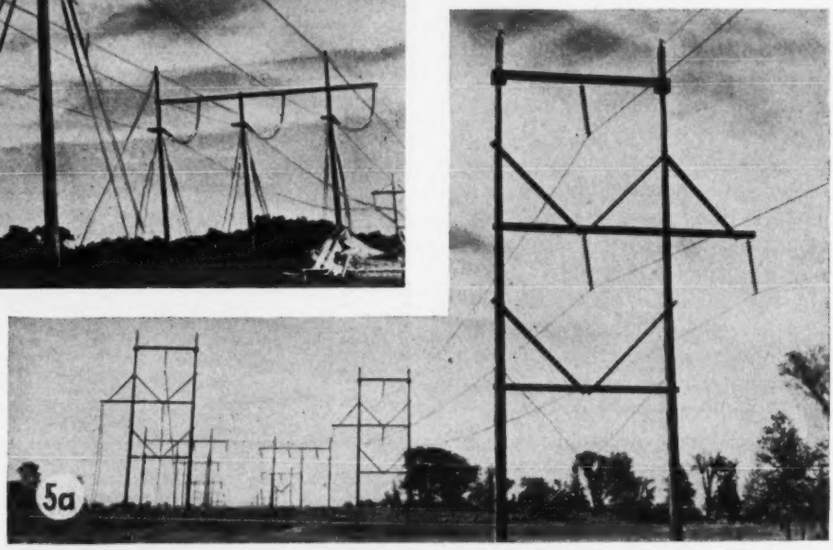
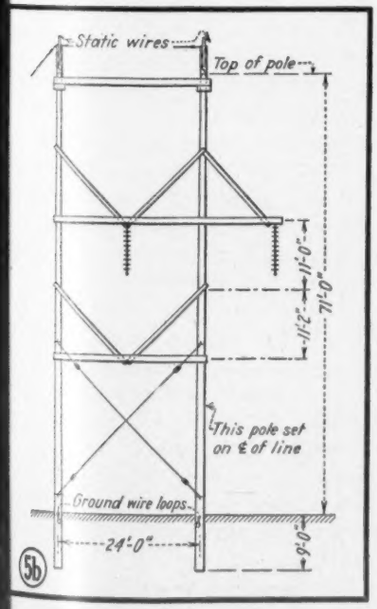


FIG. 5—Two sets of transposition structures (Type F) installed to provide one complete barrel in each circuit. (a) Taller pole requires second K-brace. (b) Overhang of arm affords prevailing 12-ft. separation from pole



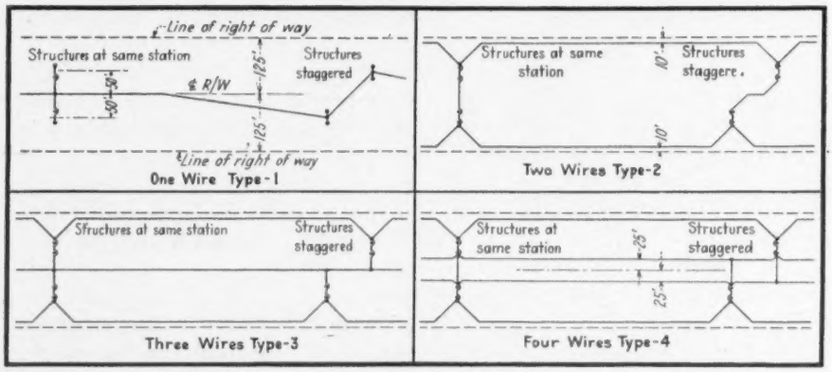


FIG. 6—Up to 30-ohm ground resistance no counterpoise wires were installed, for higher values up to 200 ohms, one wire; 200-450 ohms, two wires; 450-900, three; above 900, four. Each is a No. 5 (Birmingham gauge) solid galvanized iron conductor ploughed into 18-in. depth

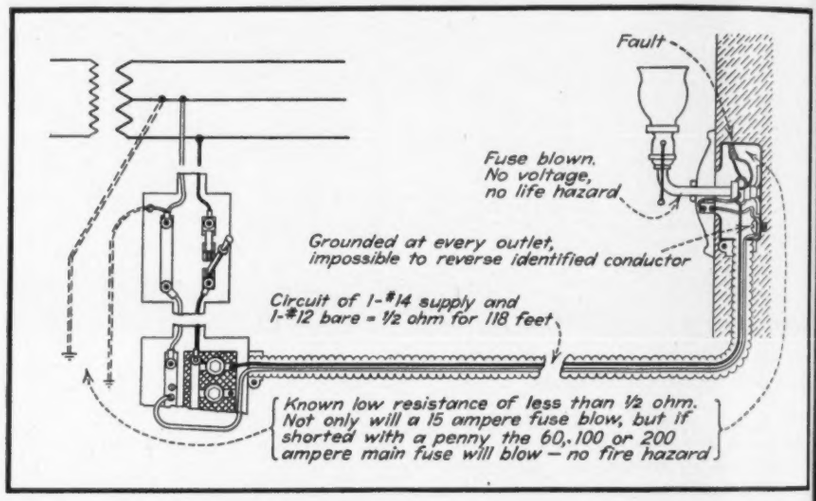
Bare Neutral Saves Critical Material

A bonded system in metal raceway presented from the standpoint of improved safety as well as the reduced use of rubber and steel

J. C. RUNYON, Consulting Engineer, Washington, D. C.

FOR YEARS progressive minds of the electrical industry have advocated the use of bare neutral. It is difficult to say whether this was initiated as a matter of safety or of economy. Those of us who are interested in the advancement of the industry from the purely engineering standpoint of better and safer construction hold to the principle that these essentials must not be sacrificed for commercial reasons of reducing first cost. On the other hand, should a safer and more logical system have the further advantage of decreasing first cost with less trouble in maintenance nothing should be allowed to hamper its use.

During the generation of arguments based on hypothetical assumptions against bare neutral, the merits of the system, as well as its advocacy, have been sufficient to admit "trial installations" of one kind or another in several inspection jurisdictions.


Fault
Fuse blown.
No voltage,
no life hazard
Grounded at every outlet,
impossible to reverse identified conductor
Circuit of 1-#14 supply and
1-#12 bare = ½ ohm for 118 feet
Known low resistance of less than ½ ohm.
Not only will a 15 ampere fuse blow, but if
shorted with a penny the 60,.100 or 200
ampere main fuse will blow — no fire hazard

SHOCK and fire hazard minimized

Trial Installations

Perhaps the most-discussed trial installations are those of Evansville, Ind., a city of 100,000, where approval was given in 1928. Reports 15 months after this approval on 1,500 installations indicate the following observations:

"All individuals interviewed expressed themselves as decidedly favoring the system."

"No troubles developed."

"Higher degree of safety."

"Positive identification — impossible to transpose neutral for 'hot wire.' "

"Impossible to connect switch in neutral leg."

"Economy of wiring materials."

Concurrently the city of Louisville, Ky., authorized similar trial installations. At that time a commercial metal-frame garage was wired with a bare copper neutral in rigid conduit supported on the steel trusses. For 14 years this has been exposed to the severe mechanical and atmospheric conditions, yet, while the installation shows signs of hard usage, the electrical operation has not given any trouble.

Since 1935 Louisville has permitted the use of bare neutral in all classes of work where application is made in advance and many buildings ranging in size from small residences to large business houses have been so wired.

So completely satisfactory has the performance been that the Louisville Board of Electrical Control, in order to further the war effort by material conservation, voted on September 10 to accept for the duration bare neutral for lighting on branch circuits and a bare common neutral up to eight branch circuits if of proper capacity for balancing.

During an investigation by the author of the use of bare neutral in Louisville, Chief Electrical Inspector H. R. Scherzer stated that from the excellent performance of bare neutral systems in Louisville he heartily indorses the system. This is further corroborated by the leading electrical contractors with whom the matter was discussed.

Bare neutral is being run in Louis-

ville in metal raceways, both conduit and E.M.T., and exposed. In one large assembly plant, just being finished, and completely wired with bare neutral, the 2,280 branch circuits are in E.M.T. on messenger cables supported from the steel trusses. Risers are in rigid conduit and overhead feeders are run exposed on insulators. In these exposed runs the neutrals are also bare.

In Wood Building

Plans have just been approved for another assembly plant of equal size, using bare neutral throughout in which the building is principally of wood. With slight modifications to fit wood construction, it will be wired in a similar manner to the above.

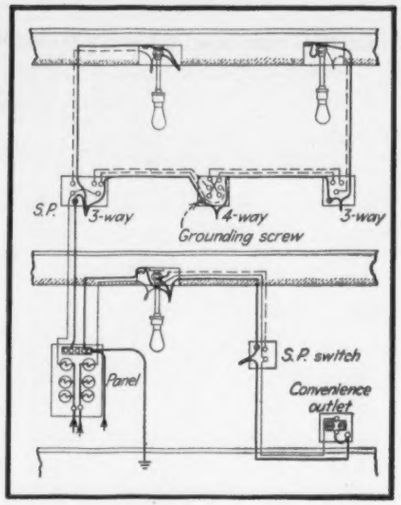
Furthermore, new garages and service stations in Louisville are now being wired with bare neutral because of the inherent safety features.

There are several ways of wiring with bare neutral in metal raceways. While the experience so far has been overwhelmingly good, some refinements might be made in the interest of safety. A system embodying the improvements and here described is offered as virtually fool-proof, safe and carrying with it all the inherent material-saving advantages of bare neutral.

Due to loose couplings, locknuts and bushings, we frequently find conduit systems poorly bonded, and in some instances the continuity entirely interrupted. Similar conditions, plus high resistance of sheath in long runs, exist for armored cable. Safety dictates that where metal is used which exposes the ground polarity it should have every provision to maintain continuity.

A frequent condition in armored cable installations is the heating of armor due to fault currents returning over the armor. There have been a number of cases where fault currents have been sufficiently heavy to heat the armor to the ignition point of adjacent material and start a fire. In other instances fault currents insufficient to cause a fire have nevertheless so energized the exposed metal of fixtures or finish plates as to present serious shock hazards to persons. We all know of the "bathroom" condition where persons have been injured or killed through contact with live parts and the ground path present in the plumbing.

A low-resistance permanent ground



BARE neutral system showing safety feature of grounding screw

connection is doubtless the most effective single means of safeguarding against casualty hazards. In conduit, armored cable and other metallic systems the use of bare neutral is ideal from several points. The neutral wire is mechanically protected, which while not necessary is advisable. The resistance can be controlled to an assured low value and the bonding to the outlet boxes and contact with the metal envelope provides a definite metallic path which shunts the otherwise stray currents. It is quite practical to limit each branch circuit to a resistance of less than ½ ohm with the method described. Such low resistance at a voltage of 110 will pass sufficient current on fault short circuit to open a 200-amp. protective device. Herein lies the safety, for instead of a fault current remaining on the line with the continuous shock hazard, and generating heat that may culminate in fire, the very fault kills its own circuit. This may be traced by reference to the diagrams.

An equally important feature of bare neutral is the identification protection. Inspection departments follow through new installations most carefully for the identification and proper connection of the grounded conductor. Then later when some ground occurs in the live side of a circuit and the repairman finds the identified wire clear he has been known to make the error of reversing the wires instead of searching out the fault. He can go away and leave the system working to the satisfaction of

Table I—Capacity Gain for Present Conduits Using Bare Neutral

Size Conduit	2 Wires			3 Wires			4 Wires		
	Insl.	Bare N.	% Gain	Insl.	Bare N.	% Gain	Insl.	Bare N.	% Gain
½	12	8	75	12	10	25	14	12	33⅓
¾	8	6	42	10	8	40	12	8	75
1	6	2	80	8	4	100	8	8	0
1¼	3	00	87	6	1	100	6	3	60
1½	0	200M	60	1	00	50	4	1	75
2	200M	350M	50	000	250M	40	1	000	75
2½	350M	500M	33	250M	350M	10	200M	0000	12
3	600M	700M	11	500M	700M	25	300M	400M	18

The above based on Table V, Chapter 9, 1937 N.E. Code.

Table II—Capacity Gain in Existing Conduits, Changing from 3-Wire, Single Phase, to 4-Wire, 3-Phase by Simply Adding One Bare Wire

Conduit	3-Wire Single-Phase		Add 1 Bare Wire		% Gain in Capacity
	No. Wires and Size	Wattage	No. Wires and size	Wattage	
½	3 No. 12	4,400	4 No. 12	7,200	63
¾	3 No. 10	5,500	4 No. 10	9,000	82
1	3 No. 8	7,700	4 No. 8	12,600	62
1¼	3 No. 6	11,000	4 No. 6	18,000	58
			4 No. 3	28,800	162
1½	3 No. 1	22,000	4 No. 1	36,000	63
2	3 No. 000	38,500	4 No. 000	63,000	63
2½	3 No. 250M	55,000	4 No. 250M	90,000	63

Table III—Insulated vs. Bare Neutral (Based on 1937 N.E. Code ratings) and Conduit Sizes (Interim amendment of 1940 N.E. Code issued September 1, 1942)

Table references: I. 2-wire, single phase.
II. 3-wire, single phase or 3-phase with one grounded.
III. 4-wire, three phase.
IV. 5-wire, two two-wire and neutral, or two-phase with neutral.
V. 7-wire, two three-wire and common neutral.

Conductors		Comparison of Conduit Sizes									
		I		II		III		IV		V	
Amp.	Size	Insl.	Bare	Insl.	Bare	Insl.	Bare	Insl.	Bare	Insl.	Bare
15	14	½	⅜ (a)	½	⅜ (a)	½	½	¾	¾	¾	¾
20	12	½	⅜ (a)	½	⅜ (a)	¾	½*	¾	¾	1	1
25	10	½	⅜ (a)	¾	½*	¾	¾	1	¾*	1	1
35	8	¾	½*	1	1*	1	¾*	1¼	1*	1¼	1¼
50	6	1	¾*	1¼	...	1¼	1¼	1½	1¼*	2	1½*
70	4	1¼	1*	1¼	1*	1½	1¼*	2	1½*	2	2
100	1	1½	1¼*	1½	1¼*	2	1½*	2	2	2½	2½
150	00	2	1¼†	2	1½*	2½	2*	2½	2½	3	3
200	200M	2	1½*	2	2	2½	2½	3	3	3½	3½
300	350M	2½	2*	3	2½*	3½	3*	3½	3½	4½	4*
400	500M	3	2½*	3	3	3½	3½	4	4	5	4½*
500	700M	3½	3½	3½	3*	4½	4*	5	5	6	6
500	2/250M	3	2½*	3½	3*	4	3½*	...	...	...	...

(a) Reduction of one size to conduit size not recognized by N.E. Code is listed only to illustrate possible saving of 23 per cent by weight of steel for war effort. Applicable to five most useful types of circuits.
* Reduction of one size of conduit. † Reduction of two sizes of conduit.

Table IV—Savings in Steel Based on the Previous Tables

Reduction of Conduit Size	No. of Circuits Affected	Steel Savings	
		% Saving Rigid Conduit	% Saving E.M.T.
½ to ⅜	5 very frequent	23	22
¾ to ½	3 frequent	25	34
1 to ¾	4	32	31
1¼ to 1	4	26	29
1½ to 1¼	4	17	15
2 to 1¼	1	38	33
2 to 1½	5	26	21
2½ to 2	2	37	..
3 to 2½	2	23	..
3½ to 3	2	17	..
4 to 3½	1	16	..
4½ to 4	2	14	..
5 to 4½	1	15	..

the occupant, but with the entire polarity reversed in the "repaired" section—all screw shells alive and all switches in the neutral! This situation is impossible with bare neutral. The fault *must* be cleared.

Generally, the search for safety in wiring has so far failed to recognize that we have in our present metallic systems the materials right at hand. It is not necessary to change a single fitting or raceway. By the simple means of adding a terminal screw, or similar bonding means, in each outlet box, as shown, and attaching the bare neutral under this bond screw we have tied the return current to a definitely controlled path and removed not only the outstanding hazards, but stray currents as well.

In our war efforts we may realize more than just the saving of rubber and other insulating materials. The use of a bare neutral will permit more useful wires per conduit or a reduction of the size of the conduit or armor for a given load. For instance, the armor of a 2-conductor bare neutral cable is approximately $\frac{7}{16}$-in. outside diameter; the standard 2-conductor insulated neutral cable now used is $\frac{5}{8}$-in. outside diameter and the armor weight $1\frac{5}{8}$ times that of the armor of the bare neutral cable—an appreciable saving in steel alone.

In existing buildings where it is desired to increase loading of circuits to step up activities, it might be possible to introduce a bare wire in the existing conduit system, thereby releasing the present conductors for the heavier demands.

These gains in capacity are given in Tables I and II. Observe that in only one case is there no gain in capacity. In most cases the gain is well over 60 percent and in one case 162 percent. Think what this means for buildings converted for war effort, not only in saving of costs but in speed of preparation for more productive occupancy!

In new buildings we find savings by the use of a smaller size of conduit as given in Table III, as well as the savings in insulation.

At present we do not have a ⅜-in. conduit, and while a ⅜-in. nominal size tubing might be used in exposed places the author does not recommend such change. Rather consider the gain in capacity of the ½-in. and other conduit sizes, less strain on labor and above all, greater safety.

It will be observed that the recommendation for bare neutral in this article bases the safety of the branch circuit on a resistance low enough to open a 200-amp. protective device. That this limit is about right is borne out in the provisions of paragraphs 3881 and 3882 of the 1940 N.E. Code.

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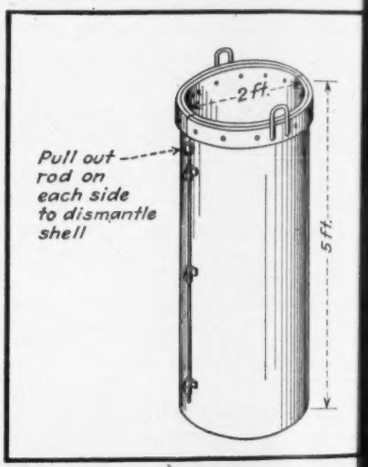
Shell Sets Pole in Marsh or Sand

By W. E. SMITH
Superintendent of Electric Distribution
Rockville Center, N. Y.



SPLIT STEEL "barrel" aids setting poles in soft soil

It is common practice to use a barrel or two to keep muck or sand from slipping back into a hole being dug in soft soil for setting a pole. Wherever it is desirable to use other means we have devised a shell of ¼-in. steel plate bent to a 2-ft. cylinder. It is split and hinged so that the two halves can be separated by pulling the long rods which pass through the welded-on ears which form the hinge. After the pole is placed first one and then the other half is pulled out by means of rings attached at the top where the sheets are reinforced by a 4-in. wide strip riveted on.

Tube Pitting Traced to Unequal Water Flow

Rearrangement of pipe in feed trough to equalize flow and eliminate "starvation" of tubes near inlet end corrected condition

RALPH BRISCOE, Detroit Edison Company, Detroit, Mich.

IMPORTANCE of proper feedwater distribution within a boiler drum, so that equal or uniform quantities of water are available for circulation to all parts of the boiler was demonstrated by an early experience with some "W" type boilers at Trenton Channel station.

In these boilers, installed only a couple of years previously, corrosion or pitting had occurred in the front row of tubes. Other boilers, installed in the station for some five or six years, however, showed no evidence of this trouble. This puzzling fact inspired efforts to discover why tube corrosion should exist in one boiler and not in another, when, for all practical purposes they were of like design.

Setup Simulated

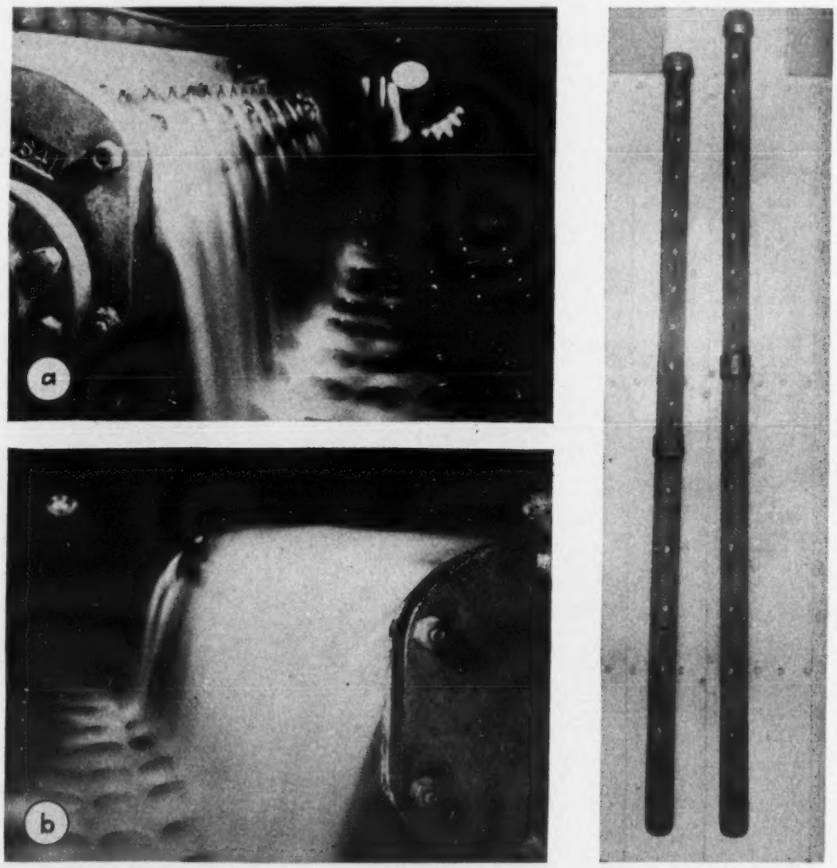
Investigation first turned to circulation, but the design was such that good circulation was accepted as a positive fact. It was recalled, however, that previous tests had shown that there was no water in the back drum of these boilers when they were in service and operating above a certain rating. It appeared logical, therefore, that if feedwater was not distributed uniformly throughout the length of the drum some tubes were receiving less water than others and pitting might be due to this condition. The method used to verify this was interesting.

Actual pressure under which water is injected into the drum and distributed is the difference between boiler feed line pressure and drum steam pressure. In this case the differential never exceeded 50 lb. Therefore, with the boiler out of service, it was possible to reproduce operating conditions rather simply. To do this the boiler feed line was disconnected and a connection made to the house service supply—about 80 lb. at this elevation. With an orifice in the line and the boiler drum manhole doors removed, it was possible to observe and measure the flow and distribution of water along the feed trough inside the drum.

Excess At One End

Since water is led into the two top, outside drums of these boilers a quantity of water equal to half the steam output was introduced at all outputs. By varying the quantity of water it was possible to observe the distribution corresponding to various outputs in the boiler.

Observation revealed that the quantity of water flowing out of the feed trough at one end was very much in excess of that flowing out of the other over a wide range of outputs. Cor-



UNEQUAL DISTRIBUTION of water at opposite ends of feedwater trough inside boiler steam drum. Flow is 215,000 lb. per hour. Hole at end of 2½ in. internal feed pipe reduced to ¾ in. It was later capped to improve distribution (b). Inlet end of feed pipe shown in (a). At right, sections of internal feed pipe through which water enters feed trough in steam drum. Pipe has been capped and part of holes closed by welding

rosion or pitting of the boiler tubes had been confined to tubes in the section where flow of water from the feed trough was the least; *i.e.*, the end nearest the inlet end of the feed pipe and in the tubes nearest to the fire. Little or no pitting occurred in the portion that was securing large quantities of water.

Distribution Improved

Correction of the trouble seemed to lie, therefore, in equalizing the distribution of water across the drum. A study was made accordingly of the feed trough and internal piping, arrangement of which is shown. The internal feed pipe of this boiler drum is about 25 ft. long, $2\frac{1}{2}$ in. in diameter and extends almost the full length of the feed trough, which, in turn, is almost as long as the boiler drum. It was connected to the external feed pipe at one end and was open at the other. In addition to the open end the feed pipe had 103 $\frac{1}{2}$-in. holes along its length, through which water flowed into the feed trough.

It was evident that the open end of the feed pipe permitted a much greater flow of water into the trough at that end than along its length through the $\frac{1}{2}$-in. holes or at the entrance end. After capping the end of the feed pipe it was still found that distribution was poor and it became necessary to plug some of the $\frac{1}{2}$-in. holes near the outlet end. Alternate holes were plugged for the first 4 ft. and for the next 4 ft. every third hole was plugged. Though this did not give perfect distribution along the trough for all outputs from the boiler, it did prove sufficiently beneficial so that the recurrence of the pitting did not take place.

Screen Drum

Trouble of the same nature, on a limited scale, was experienced on the hot screen (hearth tubes) even though a check disclosed that the internal feed pipe was sealed on the end and the distribution was quite uniform. Although distribution was uniform over the length of the drum it was found that the trough in these drums was shorter by some 3 ft. than the feed trough in the corresponding drum of the older boilers. To assist in elimination of troubles a short piece was added to the end of the trough. This change largely corrected troubles.

Telephone Service Over Rural Power Lines Studied

During the past two years the Bell Telephone System and the Rural Electrification Administration have been carrying on development work cooperatively to determine the technical possibilities of furnishing telephone service to rural power customers who do not have telephone service through channels derived from power distribution lines by carrier methods. This continued work which the Bell Laboratories had started about two years earlier, with this same objective. Using this preliminary work as a basis, the joint development program was initiated to study the technical problems in further detail.

In initiating this joint work, it was decided that (1) separate frequencies for transmitting and receiving should be used, (2) multiparty line operation should be provided for, and (3) the sets should be equipped with switches for interchanging the frequencies used for transmitting and receiving, so that calls might be made to or received from another party on the line without complicated apparatus at the central office.

Measurements made on two REA distribution projects in the field to supplement the information available on transmission losses and noise levels indicated that the controlling losses were those experienced in going through the distribution transformer, and that if adequate transmission range was to be obtained with reasonable amounts of transmitted power, some better means of coupling the carrier equipment to the line were required. The work also indicated that measures would need to be taken to reduce the effect on high frequency transmission of branch lines and bridged transformers.

Equipments Devised

While these line transmission and noise studies were in progress, development work was continuing in the Laboratories on subscriber sets. Models were built of a set designed to work on separate frequencies for transmitting and receiving, arranged to be interchanged by a switch so that the sets could make or receive calls to or from another party on the line, as well as through the central office. Automatic volume control was provided to compensate for the varying losses in the line and coupling devices, and appropriate signaling means were included. A carrier terminal set was also built for connection to the regular telephone central office.

Choke coils and networks were devised for connecting in series with branch lines and transformers, in order to reduce the transmission losses otherwise caused. Improving coupling devices involving high-voltage condensers rather than distribution transformers were provided.

To Improve and Simplify

Field experiments with these arrangements indicated that further modifications in the sets were required to improve voice transmission and to reduce interference to signaling from nearby thunderstorms. Accordingly, development work was undertaken to accomplish these results and also to simplify the sets so as to reduce the amount of apparatus required, and thus the cost.

The work has been carried to the point where experimental models of new sets have been constructed and tested in the laboratory, both as regards transmission performance and susceptibility to lightning interference, using sources of artificial lightning. Modifications have been made in the operating methods, so as to reduce the amount of equipment required, both at the subscriber set and in the central office. Work has also continued on reducing the cost of the coupling condensers. Further study of the new designs will be required to determine whether they will provide satisfactory service in the field.

After the war it is expected that work will be resumed and that further studies and trials will be begun for the purpose of evaluating the technical and economic questions to be resolved in determining the general field of application of this system.

*Present status of the joint development project as outlined by M. M. Samuels for the Rural Electrification Administration and R. G. McCurdy for the Bell Telephone System.

Wartime Contributions Absorb A.I.E.E. Sessions

Conferences and papers pivot on measures to conserve equipment and critical materials, meet the loads, insure performance, protect property, utilize all margins, advance the urgent technology and prepare for the post-war era

ALMOST equal balance between informal conference sessions and sessions at which more than 60 formal papers and reports were presented marked the national technical meeting of the American Institute of Electrical Engineers in New York January 25 to 29, 1943. The twelve conferences were devoted exclusively to intimate and practical discussions of war problems and the formal technical sessions were largely so in direct terms, practically entirely so in terms of foundation contributions.

How better to load up equipment and conductors and cables, how select the lightest motor and the least-copper distribution system for the production job, how meet the problems of defense lighting, defense education and sabotage, how build 230-kv. lines practically without steel and substations with next to no copper, how maintain and operate reliably but nevertheless frugally—these were just samples of the contributions made to the war effort by the 1,300 of the 20,000 members who participated in the sessions.

Close tie with the conservation objectives of WPB was indicated by the appearance of H. M. McDougal and several of his associates from WPB at various sessions for the purpose of interpreting and encouraging the themes as contributions to the wartime exigencies in the electrical field.

Emergency Rating of Cables

Policies of six utilities and recommendations of two manufacturers as to emergency loading of cables constituted a conference session at which G. L. Carlisle of WPB said the basic measures of conservation set up could not have been far wrong because it has led to no epidemic of cable burnouts. He said industrial engineers had been found hesitant to accept the demand-factor rather than the connected-load approach to feeder design.

Relatively little capacity gain comes from running cable temperatures up to 150 C. four or five times during life, said H. W. Collins, so Detroit Edison aims at 110 C. and once in five years. As to applicability of the limits there is little difference between old cable with dry insulation and new cable with tight sheath.

Cracks in sheath increased during overloading and after return of Philadelphia cables to normal loading, said H. L. Davis; in one instance they occurred at the high, dry middle, but the failures happened at the low, wet ends. A mere 5 C. difference in temperature makes a 15/1 increase in failure rate. Vintages of 13 kv. and 26 kv. belted and 26 kv. shielded differentiate in permissible normal daily temperatures, generally 5 C. higher for later cables, on Public Service Electric & Gas, said G. C. Dean. W. A. Del Mar, Habirshaw, said a cable is living on borrowed time when the hottest spot temperature passes 105 C. Herman Halperin reported no adverse experience from Commonwealth Edison's consistent program of leadership in working cables warmer; better load factor had fostered higher temperatures; Chicago has saved 1,000,000 lb. of copper and almost as much lead.

Sheath deterioration does not have to be the limiting factor in emergency operation, said E. W. Osterreich, Duquesne Light, and he showed how it can be controlled by manhole in-

J. Elmer Housley, Aluminum Company of America; A. D. Avtzine and A. V. DeBeech, Canadian General Finance; J. A. French, Jackson & Moreland

A. C. Monteith, Westinghouse; L. M. Robertson and H. F. Gidlund, Colorado Public Service; H. V. Nye, Allis-Chalmers; M. S. Oldacre, Commonwealth Edison; J. R. North, Commonwealth & Southern

stallations and repairs. G. B. Shanklin, General Electric, said the greatest return in copper saving can be obtained on circuits on which the rating is established by infrequent short-time overloads.

Loading Equipment and Systems

Prompt but tentative reports by two subcommittees of the power generation committee constituted the core of recommendations and suggestions for emergency methods to increase the output of the nation's power systems if and as the war load really taxes them. C. M. Laffoon's group pointed to the following factors: Limiting generator output hinges not only upon all auxiliaries to the prime mover but to the character and state of its insulation, the ambient and the different thermal properties of rotor and stator; replacement with Class B insulation affords prospect of 15 percent increase in output; intermittently operated machines present more problems because of cyclic temperature changes and consequently the temperature during shutdown should be kept as high as possible by elevating the cooling medium; stability considerations should not be overlooked.

R. P. Crippen's group made several extensive surveys and these were reported in comprehensive detail. Preventive maintenance schedules in some instances are not being rigidly observed; not all found it necessary to step them up to compensate for increased service duty; delays and deferments are due primarily to materials and parts stringencies. Short-time operation at high temperature is often preferable to keeping much spinning reserve. Advantage can be taken of favorably low ambients. Full-load rated temperature is reached on many turbo-generators with fifth-load on two phases and none on the third; balance is essential.

Several companies said it had not been necessary so far to operate generators above manufacturer's nameplate rating; emergency overloading confined to transformers and circuits.

On tie-line load-control equipment there was much diversity of opinion and acceptance—for weak links, yes, but strong ties, no. Reduction of frequency during capacity emergencies is viewed as effective where resistance loads out-total the motor and furnace loads. Reduction of voltage for similar objective does not meet favor for more than brief periods of emergency. Difficulty in obtaining automatic equipment and of personnel competent to maintain it are the present deterrents to adoption to relieve manpower shortage.

Silver-plating of contacts, idle transformers cut in as line boosters, rehabilitation of cooling towers, radiators on leads to apparatus bushings, extensive use of fans and blowers, reversal of hydro-generator windings to get new corona life, glass tape for hot-ambient apparatus windings, switching off lightly loaded transformers, addition of turning gears were among many measures advanced to ride out the emergency.

Transformer Loading

Cooling Power Transformers by Forced Circulation of Cooling Medium. By **K. K. Paluev** and **L. H. Burnham** (both General Electric).

Saves materials, transportation, installation, space, cost, heat energy; reduces oil contamination, leaks, hotspot limitations; advocated directed flow; ⅓ increase in loading often attainable.

Equivalent Ambient Temperatures for Loading Transformers. By **W. C. Sealey** (Allis Chalmers).

Average ordinate of curve derived from actual ambient by multiplying its ordinate by the 8-degree aging factor. Annual equivalent ambient tabulated for 28 cities.

The Rating of Power Transformers as Determined by the War Emergency. By **R. J. Salsbury** and **A. F. Phillips** (both Duquesne Light).

Without exceeding hot-spot limits, 20 banks have carried loads up to 160 percent nameplate rating by equal-life rating of individual transformer on recurrent loads.

Substation Transformer Emergency Overloading Practice. By **L. W. Clark** (Detroit Edison).

Allowable load-carrying ability and actual load both converted to steady 24-hour basis to establish equivalent insulation aging. Nomographs given, for winter and summer. Empirical factors for load-curve conversion.

The Paluev-Burnham paper on forced circulation cooling of power transformers drew from W. C. Sealey, Allis-Chalmers, and W. G. James, Westinghouse, the comment that while the authors laud forced circulation for core-type transformers it works equally well for both core and shell type, a statement that the authors conceded in closure. F. J. Vogel, Westinghouse, could not concede the authors' suggestion that zigzag flow of oil through the core and winding assembly was a natural arrangement. W. C. Sealey described the forced-oil circulation system developed by Allis-Chalmers to provide increases in nameplate ratings up to 66%.

W. C. Sealey's method of calculating equivalent ambient temperatures for loading transformers met with

the objection from F. J. Vogel, Westinghouse, that the assumption of doubled aging for every 8-deg. C. rise in temperature was at variance with previously reported experience. Vogel's findings were that there is no loss in strength of insulation under 105-deg. C. operating temperature.

V. M. Montsinger, General Electric, found Sealey's assumption of sinusoidal variation of temperature with time sufficiently accurate for practical purposes. He suggested three guides for the use of daily average ambient and annual equivalent ambient to determine overload capability: (1) For one-day emergency overloads use daily average ambient; (2) where load is constant throughout the year or when greater capacity requirements are in summer months use equivalent annual ambient, and (3) when greater capacity requirements are in winter, determine the equivalent ambient for the heavy load months and for the light load months and check the load capability for both periods.

F. J. Vogel, Westinghouse, was not in entire agreement with the Salsbury-Phillips paper because of the use of the 8-deg. rule as its basis. He also cautioned further that 200 percent loads on transformers may overburden bushings and taps even though other elements withstand the added load burden.

In the Clark paper V. M. Montsinger, General Electric, noted reference to 120-deg. C. hot spot for 24 hours as reducing life of the insulation 1 percent. While he found the figure 10 deg. C. higher than the 110 deg. mentioned in the recent report of the transformer subcommittee on transformer overloading, Clark's safety factors were considered ample to take care of the higher temperature. Both Montsinger and H. B. Wolf, Duke Power, found the author's figure of 10-15 percent increase in capacity by fan cooling rather low. Values of 25 to 33 percent overload with standard small fans are more common, they stated. In clarification, Clark pointed out that in high overload ratings, where without fans overloads of 150 to 160 percent have been obtained, the use of fans will give an increase of only 10-15 percent.

Transmission Lines

Abnormal Overvoltages Caused by Transformer Magnetizing Currents in Long Transmission Lines. By **H. A. Peterson** and **T. W. Schroeder** (both General Electric).

Transient analyzer studies for range of significant variables ferrets out regions of abnormality. Remedies: synchronous condensers, shunt reactors, second harmonic shunts.

Wood-Pole, 230-Kv. Transmission Lines. By **O. S. Clark** (War Department).

K-braced 60-ft. poles with latticed-steel ground-wire extensions; 3-pole angles and dead-ends; spliced timbers for crossarms.

Transmission Line and System Problems in Supplying Large Electric-Arc Furnaces During Wartime. By **B. M. Jones** (Duquesne Light Co.).

Data on shorts, impedances, regulation and system hookups devised to serve 20 furnaces in ten plants (up to four 25-ton, 10,000 kva.); kva. ratings range from 523 to 723 kva. per short ton; 15-minute demands 90 to 104 percent of ratings; peacetime performance relaxed.

Intrasystem Transmission Losses. By **E. E. George** (Ebasco Services).

Sets up 55 steps in computing losses by applying basic formula devised for given system using hourly log readings.

Ampere Load Limits for Copper in Overhead Lines. By **A. H. Kidder** and **C. B. Woodward** (both Philadelphia Electric Company).

Theoretical and experimental background for tabulation of practice loading of bare and covered conductors to give up to 175 C. copper temperature for emergency loading for non-coincidence of peak and adverse wind and ambient conditions. General formula developed.

Clarke supplemented his presentation of the paper on the 230-kv. wood-pole line (see elsewhere in this issue of ELECTRICAL WORLD) by saying the line had ridden uneventfully through a ½-in. glaze since operation began July 1, 1942. If done again the bayonet extension would probably be made stronger. The cost of materials was about $10,000 per mile; labor costs ran high because of speed of erection in an unfavorable season.

Supplementary reactance is seldom required, said O. B. Falls, General Electric, for furnaces larger than 7,500 kw. He suggested collection and recording of more data on the X of bus, leads, electrodes, etc. With such data at hand the utility would need know only the secondary E and I to be able to predict flicker. Swings run higher where iron-cored reactance is dominant. H. P. St. Clair cited installation of a series capacitor to compensate a tie line up to the point of a furnace branch line; the flicker resides in the impedance of the branch line. He agreed with Jones that it is difficult to get the furnace operator to use the adjustable reactance effectively. It is equally difficult to get information from the furnace manufacturer, said Jones, who added that many lines would have to be reinforced after the war because WPB had

H. K. Sels, Public Service Electric & Gas; C. F. Wagner and G. D. McCann, Westinghouse; A. H. Lovell, University of Michigan; P. L. Alger, General Electric; J. T. Binford, American Telephone & Telegraph; E. T. Mahood, Bell Telephone

been tight with copper and generous with flicker.

Five informal papers at an evening conference continued the theme of the Kidder-Woodward paper and all are associated with the E.E.I. and industry effort to set current limits for conductors just short of excessive damage to strength and insulation or covering. Much of the discordances in individually assigned amperes appear to be due to uncertainty about the annealing temperaure of copper and the universality of the computations for heat dissipation and temperature rise. Tests by Commonwealth Edison, said Herman Halperin, showed WP compound softening at 50-55 C. with blisters and pustules at 111-113 C.; even lower values pertain to pre-URC weatherproofs. H. A. Enos, American Gas & Electric Service, was critical of the computations and some of the factors in the Schurig and Frick formula; calculations show a non-negligible reduction of 55 amp. for No. 4/0 wire because of solar radiation; there seems to be little warrant to stretch ampere loadings to the limit, because of excessive losses and regulation. Earl Kendall, Commonwealth & Southern, was dubious about 175 C. (better 100-125 C.) because of inevitable weak spots in copper due to abuse in handling, etc.

At this evening session Rolf Selquist said Copperweld could stand appreciably higher loading temperatures than copper; under comparable conditions current should be taken at 75-90 percent of the value for copper of corresponding cross-section. H. R. Stewart, New England Power, concurred in F. A. Longley's skepticism about the sanctity of the 100 C. annealing temperature for copper; studies should be based on samples taken from working lines so as to include average prior history of cyclic annealing, stretch hardening, mistreatment, etc. G. W. Stickley, Aluminum Company, said exposure of ACSR to 200 C. for two months actually increases the strength slightly.

Comprehensive research among numerous authorities on annealing was reported in a summary by Myron Zucker, Detroit Edison. Purity, content of oxygen and silver are basic criteria. Silver at 0.25 percent has 300 C. annealing, lake copper 250 C. and electrolytic (0.001 percent silver) about 200 C., based on 5 percent decrease in strength. Above 0.02 percent the oxygen content makes little difference. The paper carried many charts and two nomograms for copper and ACSR, without and with varying wind. L. F. Hickernell presented Anaconda data paralleling that given at the recent E.E.I. meeting in Cincinnati. He emphasized that annealing of copper involves both time and temperature; connectors of the drawn type are not bottlenecks to high current loading. Wade Burleson, Ohio Brass, said transmission wire encounters more variables than distribution and that splices and clamps may cause localized conductor heating many times per month, particularly from magnetic influences for currents exceeding 400-500 amp.

The many tables in these presentations are evidently headed for reconciliation and correlation by a committee before all the variables can be resolved and a nation-wide program of conductor loading-up extended as required.

Transmission and Distribution

Dielectric-Recovery Characteristics of Large Air Gaps. By **G. D. McCann** and **J. J. Clark** (both Westinghouse).

Finds that appreciable number of lightning flashovers occur at such time relative to normal system voltage cycle that only a very short duration fault is produced. Dictates reclosing times.

Impulse and 60-Cycle Characteristics of Driven Grounds—III. By **P. L. Bellaschi** and **R. E. Armington** (both Westinghouse).

Lead and ground inductance particularly significant for rapid discharges where IX exceeds IR. Shallow grounds better on steep-front, high currents.

Harmonics and Load Balance of Multi-phase Rectifiers. By **R. D. Evans** (Westinghouse).

Points to optimum number of phases and transformers for least wave-shape distortion compatible with heating of generators and capacitors as well as conformity with requirements of telephone systems as to noise.

Pulling Loads on Single- and Multiple-Conductor Impregnated-Paper Lead-Encased Cable Solid Type. By **A. P. S. Bellis** (J. A. Roebling's Sons Co.).

IPCEA report on comprehensive tests using Kellems grips give formula and recommended pulling tensions.

Electrical Stability of Electrical Insulating Oils Under Limited Oxidation. By **J. C. Balsbaugh** and **A. G. Assat** (Massachusetts Institute of Technology).

P. F. rises with increased copper (or lead) area in contact, particularly in strand space. Small percentage of aromatics desirable in cable oils. A sponsored research.

Metering Power on the Low-Voltage Side. By **A. J. Petzinger** and **B. E. Lenehan** (both Westinghouse).

Discusses four instrumental methods (plus combinations) for including transformer losses; loss meter, line-drop compensator, dummy loads, and altered watthour meter calibration to fit transformer efficiency curve.

F. O. Wollaston, Commonwealth Edison, inferred from the Bellaschi-

Tom Fort, Westinghouse; E. Hansson, Pennsylvania Water & Power; Harry Wulfing, Commonwealth Edison; L. F. Ferri, Ohio Public Service; P. R. Knapp, Toledo Edison; Herman Halperin, Commonwealth Edison; E. S. Ross, Sun Oil

C. M. Laffoon, Westinghouse; M. C. Miller, Ebasco Services; R. T. Henry, Buffalo Niagara; A. G. Dewars and E. A. Willson, Northern States Power; J. W. Butler, General Electric

Armington paper that deep grounds should be the resort only after multiple surface grounds had been given full opportunity.

Citing the Curtin article in ELECTRICAL WORLD of January 9, 1943, J. W. Butler doubted the necessity for critical analysis of rectifier installations; multiphasing plus capacitors had been found amply efficacious in large rectifier installations. J. H. Cox (Westinghouse) asked C. F. Wagner to say for him that harmonics are a small matter of concern and few filters have been necessitated even on small systems.

Few cable failures had occurred in Chicago that could be attributed to sheath or insulation damage due to pulling stresses, said Herman Halperin; pulling eyes are more commonly used than implied in the Bellis report. H. S. Phelps, Philadelphia Electric, joined Halperin in commenting on the disparity between tests by Bellis, Moore (University of Illinois) and Philadelphia Electric; to him it seemed preferable to follow Bellis for pulling stresses and the other authorities on the limits of internal pressure. Calcium lead has advantage for short-time high stress, but little for long duration of moderate internal pressures.

On the loss metering topic Walter Wagner asked Paul MacGahan to say on his behalf that actual field applications have given better results than the modest claims in the paper. G. B. Schleicher gave data for thirteen recent installations of compensating metering around Philadelphia. Coleman and Morris of American Gas & Electric Service Corporation said the various low-voltage methods of loss metering needed such discussion to win them the degree of acceptance accorded high-voltage procedures; but they did believe that the complications may lead to worse errors from faulty connections than would be incurred by ignoring the losses. L. D. Price, Public Service Electric & Gas, said loss metering is not a universal money-saver, it adds complexity to accounting, does not meet control of circulating currents, reverse flows and need of totalization. Multiplicity of utilization voltages in any industrial plant dictates high-voltage metering. C. V. Morey said Consolidated Edison finds it difficult to ustify special metering equipment for losses under any circumstances; the company has three installations comprising a dummy load for core loss and meter-curve modification for copper losses. A. E. Knowlton, ELECTRICAL WORLD, expressed the feeling that regulatory authorities would be likely to favor methods which left the actual load metering intact and independent of efforts to register or estimate the losses.

Substation Design Conference

Most of the thirteen informal papers at this conference were announced as "off the record," partly because of the treatment of sabotage measures. It can be said, however, that the subject matter pertained also to design modifications that are saving many tons of steel and copper. Pictures were shown of stations that required surprisingly few poles once the departure from steel had gripped the designer. Satisfaction with tailor-made structures as to life and salvage value was expressed, but some patterns still take too much steel, according to one comment. Virtual running of the buses on the bushings was one extreme. Rubber-jacketed control cable in trenches has given good performance.

Sales forces are doing station guarding on one system and dogs may be recruited to supplement them. Ordinary limit switches make fair intruder protection along fence lines. Flying taps on one property have greatly simplified the terminal structures. Proper bracing is recognized as necessary for wood mounting of motor-operated air-breaks. Bus regulation and shift of existing regulators to parallel-five capacity has obviated purchase of incremental regulators.

Power Delivery Systems

Steady-State and Transient-Stability Analysis of Series Capacitors in Long Transmission Lines. By **J. W. Butler, J. E. Paul** and **T. W. Schroeder** (all General Electric).

Network analyzer studies. Comprises comprehensive family of performance charts for long lines with reactance compensation disposed. Optimum compensation affords opportunity to raise steady-state limit of existing lines. Cautions, therefore, against skimping on conductors.

Self-excited Oscillations of Capacitor-Compensated Long-distance Transmission Systems. By **R. B. Bodine, C. Concordia** and **Gabriel Kron** (all General Electric).

Analysis of equivalent circuit on network calculator shows that hunting on fully compensated long lines can be prevented by a proper generator amortisseur without experiencing electrical self-excitation.

Mobile Capacitor Units for Emergency Loading of Transformers in Open Delta. By **H. B. Wolf** and **G. G. Mattison** (both Duke Power).

Regulation recovered and kva. loading

I. W. Gross, American Gas & Electric Service; H. B. Wolf, Duke Power; J. E. Clem, General Electric; E. K. Huntington, Rochester Gas & Electric

reduced from 173 to 125 percent on two kva. transformers connected open delta on 225 kva., 0.75 p.f. load by connecting enough capacitance on the phase lagging the open delta to bring p.f. to 0.90 and half as much capacitance on the open phase.

Kilowatts, Kilovars and System Investments. By **J. W. Butler** (General Electric).

Kilowatts and kilovars independent entities. Capacitors at load entail 2 to 6 percent of system investment versus 20 to 25 percent in case of reactive supplied by kw. generators at plants. Weight ratio per kvar. (including mounting, housing, etc.) is 5 pounds, against 330 of critical materials.

Open-Delta Transformer Banks—Analysis of Circuit. By **J. E. Clem** (General Electric).

Open-delta unbalance creates negative sequence voltages which may increase heating of induction motors on secondary; method (charts) given for estimating capacitance for Wolf-Mattison methods of compensation.

Shunt Capacitors. By **General Systems Subcommittee**, Committee on Power Transmission and Distribution.

Comprehensive and authoritative summary of history, economic merits, protection and application for current limitations, voltage-drop, loss-reduction and over-all system benefits.

This first of several sessions on transmission and distribution devoted to discussion of war problems brought from Chairman Sporn the remark that it had taken the war to bring the capacitor into its own. All the papers on the well-attended session bore on the utility of the capacitor.

Inference by J. G. Holm, Stone & Webster, that lines shorter than 150 miles could not justify series capacitors brought dissent from author Butler. He said the decision rested on consideration of load and losses; in general, compensation cannot exceed 75 percent without incurring the risk of taking excitation away from the generators.

H. P. Seelye, Detroit Edison, called attention to an open-delta scheme (ELECTRICAL WORLD, April 19, 1929) which is geared to situations where small three-phase loads are superposed on large single-phase. A small three-phase transformer closes the otherwise open delta and carries the three-phase load independently. In closure, Wolf said that they had relatively few cases of such load division; he mentioned unsuccessful trials with use of different voltage taps on the legs of the vee in an effort to balance voltage.

On the Butler kilovar paper H. K. Sels, Public Service Electric & Gas, said the concept of segregating kws. from kvars. does not offer a simple approach to a rate, nor does it cover investments in anticipation of future loading. He felt the paper oversimplified the problem and others joined him in the assertion. His company had put in 7,500 kva. of synchronous condensers under favorable conditions at costs comparable to capacitors; the synchronous unit helps better in holding up voltage during disturbances. It is also to be recognized that the cost for kvar. demand metering should be less than that of kw. demand metering; he favored the arithmetical addition of a fraction of the kvars. to the demand kw. Magnetizing current and line X can logically be handled in many instances by available generator margins, said W. R. Brownlee, Commonwealth & Southern; bus regulation in conjunction with tap changing obviates much resort to capacitors. Greatest possibility for capacitors appeared to exist in metropolitan areas, in the opinion of H. P. St. Clair, American Gas & Electric Service; he showed the strategic location and functioning of synchronous condensers along the interconnection from Philo to Fort Wayne.

Butler felt he "had been extrapolated too much" in the discussion. This came after Chairman Sporn had discerned too much generalization in the apportionment of kvar. investment. Even such sources of kvar. capacity as come from raising hydrogen pressure can show lower increment costs than capacitors. Also, Sporn said there was too much faith in the universality and infallibility of capacitors; also that acceptance of kvar. metering had a long road ahead of it.

Circuit Interrupters

An Improved Axial Air-Blast Interrupter for Severe Operating Duty. By **P. L. Taylor** and **H. W. Martin** (both Allis-Chalmers).

Confirming tests of elevated interrupting ceiling for 150,000-kva. 5-kv. metal-clad breaker with streamlined refractory throat and tungsten-silver arcing contacts.

A New 50,000-Kva., 5-Kv. Oilless Circuit Breaker and Metal-clad Switchgear Unit. By **R. C. Dickinson** and **B. I. Hayford** (both Westinghouse).

Deion principle extended to lower rating. Parallel blades, arc plates fewer, thinner and closer, magnetic blow-in enhanced. Applied in draw-out unit.

A Vertical-Flow Compressed-Air Circuit Breaker and Its Application on a 132-Kv. System. By **H. A. P. Langstaff** (West Penn Power) and **B. P. Baker** (Westinghouse).

Service operations and ice-chamber tests on outdoor breaker of vertical column design with isolator; three pole interlocked and synchronized; one current transformer for both differential and line protection.

The Auto-Blast Interrupter Switch. By **E. A. Williams** and **W. G. Harlow** (both General Electric).

Non-automatic air switch combines functions of disconnecting switch with non-fault, non-overload interruption. Each pole has arc chute into which an automatically initiated blast drives the arc. Arcing time one to two half-cycles.

A Multiorifice Interrupter for High-Voltage Oil Circuit Breakers. By **L. R. Ludwig** and **W. M. Leeds** (both Westinghouse).

Laboratory evolves lowered arc energy dissipation, reduction of interrupters from six to two per pole for 230-kv., short arcing time on low currents and restriction of overvoltage due to re-striking.

A discussion prepared by C. P. Garman, Los Angeles Bureau of Power & Light, recited the conditions on the Boulder Dam-Los Angeles

287-kv. lines which were met by the interrupter device described in the Ludwig-Leeds paper. These conditions included the building of a third 287-kv. circuit and the inclusion of two additional generators in the high-tension ring, thus increasing the breaker duty requirements to more than 3,000,000 kva. It was desirable also that speed of interruption of charging currents be increased to five cycles or less. Mr. Garman stated his expectation that the multiorifice interrupter when built into the Boulder breakers will meet these requirements and will interrupt charging currents in four cycles or less without tendency to restrike.

Commenting also on the Ludwig-Leeds paper, J. T. Logan, Georgia Power, suggested in the interest of service reliability of transmission lines that attention should now be given to lessening the time of breaker closing to a value commensurate with the speed of opening. R. A. Hentz, Philadelphia Electric, discussing the four papers on air breakers on the session program, stated two conclusions derived from experience with several hundred air breakers of many sizes and ratings on the Philadelphia system. They were (1) that electrical design of interrupting elements is in general satisfactory and (2) that most troubles result from faults in mechanical design. A definite advantage of the air breaker, he said, was its ability to interrupt charging currents more effectively than the oil breaker. Mr. Hentz advised that particular attention should be given by operators to elimination of moisture from air used in pneumatically actuated breakers.

Switching and Lightning Protection

Oil-impregnated Paper High-Voltage Condenser Bushings for Circuit Breakers and Transformers. By **A. J. Lingal, H. L. Cole, T. R. Watts** (Westinghouse).

Oil supplants shellac and resins in interchangeable, hermetically sealed designs, encouraged by success of Detroit Edison's similar rebuilding of many 132-kv. bushings.

Application of Lightning Protective Devises in Wartime. By **I. W. Gross** (American Gas & Electric Service Corp.)

Interim suggestions for conservation; reduced-rated application, line in lieu of station-type, rebuilding with fewer elements, substitution of gaps, shortened leads, omitted ground leads, amplified station shielding.

H. S. McGee, Travis Cox, L. D. Fordham, C. A. Jaques, all Public Service of Northern Illinois; L. C. Aicher, Allis-Chalmers

The Cathode-Ray Oscillograph Applied to Long-time Switching Transients. By **G. W. Dunlap** and **N. Rohats** (both General Electric).

Uses low-voltage (1,300-volt) tubes with moving film and automatic beam control to record transients up to two-second duration.

Preliminary Report on Guides for Application and Operation of Circuit Breakers and Switchgear. Committee on Protective Devices.

Résumé of measures conducive to material conservation and increased load-handling ability.

In discussion of the Lingal, Cole, Watts paper, G. A. Mathews, Detroit Edison Company, stated that experience with the rebuilding of 12-year-old condenser bushings at Detroit in 1936 using oil-impregnated paper proved its practicability. After three years of service these bushings showed no deterioration. Some 500 bushings have since been similarly rebuilt. Departure was the use of nitrogen gas under slight pressure to exclude moisture and give warning of undesirable increases of internal bushing temperature.

In discussion of the committee report on the application of circuit breakers, A. C. Zeese, Consolidated Edison, described a device developed for silver plating in the field the confined spaces of laminated copper brushes of d.c. circuit breakers. Five mils thickness on solid contact surfaces withstands roughly 250 operations, he said. Where brushes are stiff, thinner coatings of 2.5 mils give comparable performance.

Further discussion of the committee report drew from F. R. Ford, Philadelphia Electric, the comment that tests show increases in breaker contact resistance of two to five times initial when operated at emergency total temperatures up to 90 deg. C. Harold Cole, Detroit Edison, reported no deterioration of breaker contacts at emergency total temperatures of 125 deg. C.

Industrial Power

Paired-phase Bus bars for Large Polyphase Circuits. By **L. E. Fisher** and **R. L. Frank** (Bulldog Electric Products Co.).

Minimized skin effect, proximity effect, temperature rise, *IR* and *IX* drops, voltage unbalances and structural difficulties for heavy industrial loads at low voltage. Example computed.

Synchronous Motors with Controlled Excitation for Suddenly Applied Loads. By **W. K. Boice, B. H. Caldwell** and **M. N. Hallberg,** (all General Electric).

Increased excitation with increased loads, particularly sudden ones, improves regulation, reduces system and motor losses, controls reactive, permits smaller field copper. Steel also saved. Design calculations.

Discussion of the Fisher and Frank paper centered naturally on the fact that the "paired-phase" arrangement described is a special form of the laminated and interlaced buses that have long been in use, an effort to combine the minima of reactance and of temperature rise in one design. L. L. Fountain, Westinghouse, did not agree with the authors that tap-offs are simplified by "paired-phase," said the design would not be suitable for bus runs in inclosed switchgear and expressed some dissatisfaction with the spacings in the laminated arrangement used in the comparative tests reported. Question as to whether or not equally good results might be obtained by closer spacing of inter-

E. B. Paxton, General Electric; Joel Tompkins, Aluminum Company of America; E. E. George, Southwestern Power Pool; H. Chestnut, General Electric

laced buses was voiced by W. K. Boice, General Electric.

Advantages corresponding to the application of controlled excitation to generators should be realized by its use with synchronous motors, said S. B. Crary, General Electric, in reference to the Boice-Caldwell-Halberg paper. But from the following discussion one could not be too sure of that conclusion. K. W. John and J. J. Orr, United States Rubber, pointed out that the development described in the paper was concerned with the large synchronous motors used in steel mills and they wondered about its virtues in application to the smaller sizes of synchronous drives in the rubber, cement and other industries. Could controlled excitation be applied to existing drives or must it be confined to designed installations? To which the only answer that seemed to be capable of being given was "That depends on motor and load characteristics."

Industrial Distribution Conference

A "Proposed Wartime Guide for Industrial Power Distribution Systems" was rushed through by the industrial power applications committee for discussion and suggestions. It already comprises 53 pages and discussion indicated it might grow into a manual of layout of systems large or small, best to meet the needs of production plants. It is so basic and comprehensive as already to be serving the pattern for the extensive wiring on planes and ships as well as navy yards and war plants. P. L. Alger called it one of the most embracive of the several guides being sponsored by his technical program committee. J. J. Orr, U. S. Rubber, chairman of the industrial committee, says requests have already been made for discussion at the coming Kansas City meeting and at early meetings of other power and industrial groups.

Much discussion focussed on demand factor. M. J. McHenry, Toronto, said that of 1,500 motors surveyed by the Hydro Electric Power Commission 40 percent never operated over $\frac{1}{3}$ rating, 60 percent not over $\frac{1}{2}$ and 85 percent never reached full load. Others urged collection of data on the demand factors of individual motors, circuits and departments. D. K. Blake, General Electric, felt duplicate feeders inside plants were far less necessary than on the outside, more-exposed lines of the power company. Oscar Bauhan, Newark, showed how a protected loop affords dual service.

Military and Farm Loads

Estimating Electric Loads for Military Training Bases, Federal Housing and Other Wartime Projects. By **H. M. Potts** (Bonneville Power Administration).

Comprehensive data on connected loads, demands, demand factors, cumulative load factors, peak responsibilities, watts per man (for one and three-meal sittings).

Rural Electrification Engineering and Electroagricultural Engineering. By **M. M. Samuels** (REA).

Points to call for lowered core loss, simple ground meters, protective devices, water pump, dehydrator, feed and flour grinding, quick freezer, brooder, soil treatment and pest control equipment.

Little parallelism is to be observed between loads of army cantonments and ordinary urban domestic loads, said H. P. Seelye, Detroit Edison, comparing the data in the Potts paper with characteristics of residential loads on utility lines. D. K. Blake, General Electric, pointed out as further differences between the two types of load the concentration of cooking, the small use of secondary copper and the lack of concern for user good will in service to army camps.

The Samuels paper drew some fire for its implication that rural electrification engineering began with the REA and its direct statement that distribution engineering really started with the a.c. network. To contest these statements arose A. B. Campbell Edison Electric Institute, W. R. Bullard, Ebasco Services, and Donald Henry, Stone & Webster Service, who cited ample history proving the opposite on each charge.

A conference paper by S. B. Williams, ELECTRICAL WORLD, suggested —and the meeting approved it—that the A.I.E.E. study the basic elements of safety to life and property in electricity applications for the purpose of developing unity values for safety to be used as standards to which factors of safety could be applied. Such basic determinations should simplify the work of their compilation and strengthen the codes of electric safety requirements. R. B. Shepard, Underwriters' Laboratories, while deploring certain intimations of commercial compromise in the National Electrical Code, agreed that Mr. Williams' suggestion had merit.

Another conference paper by W. L. Tadlock, Commonwealth & Southern, disclosed a method of load analysis originally developed for the determination of distribution system values of uncontrolled water heaters, but applicable to other kinds of load as well.

In his conference paper on wartime electric motors and their postwar application, J. L. Hamilton, Century Electric, pointed out that insulation has always been and still is the bottleneck of motor capacity. What possibilities developments in plastics may open up in the way of new insulations must be left for later consideration.

PRIORITIES PROBLEMS

Guides for War Plant Design

By this time the urgency of designing wartime electrical facilities and expansion, as well as plant facilities of all sorts, to use the least practical amount of critical materials is generally appreciated. Established practices of the pre-war period must be largely discarded for the duration and electrical layouts prepared to conform with the necessities of the day.

How to accomplish this is the problem. Application of the "bare bones" idea obviously varies in individual instances.

There have grown up through the experience of the WPB Office of Power Director's staff a number of rather specific principles which are used as a guide in passing upon electrical layouts for war projects and in authorizing priorities for materials with which to build them. These guides are not formalized in any order equivalent to Order P-46 for utility repair and maintenance.

To Save Time

But when they are followed rigidly it takes a minimum of time to get authorization, thus speeding completion of needed war jobs. When layouts are submitted which call for more material and equipment than is required there's inevitably delay and negotiations while the specifications are stripped down.

Here are the guideposts for designing the type of "bare bones" electrical layouts which can pass muster with WPB:

Include no auxiliary sources of supply or duplicate equipment for emergency or breakdown service. Only one source of supply is permitted except in extraordinary circumstances; WPB is often willing to gamble the saving of materials for emergency equipment against possible loss of production from breakdowns.

Design for load factors instead of connected load. In considering this design feature, the following load factors have been found generally applicable: Crane operation, 25 percent; welding machine operations, 35 percent; general machine shop operations, 60 to 80 percent, depending on the type of work done. Not only can there be no margin of emergency spare in electrical layouts but also proposed designs must plan for only the amount of equipment needed for the minimum permissible load factor.

Enough, but No More

Specify equipment which is no larger than that required for the kilowatt demand and design it to work at or above its normal rating. This applies equally to conductors and to functional items, switchgear, transformers, regulators, reactors and similar equipment. No equipment of any kind is permissible to provide for possible future loads or extensions—maybe they won't materialize.

Taper buses and feeders where there are long runs with loads being taken off along the run. This is simply a further refinement of the principle of having equipment no larger than is needed for the job at a given point. Reserve or auxiliary buses and their attendant equipment are, of course, prohibited.

Consider the fullest use of capacitors where they will result in a saving of copper and steel in feeders, transformers or other equipment from power-factor improvement and current reduction.

Pre-Pearl Harbor safety factor practices are now a war casualty. No factor of safety in operating equipment gets WPB's OK. For instance, WPB requires the elimination of the usual safety switch in series with the starting switch of a motor on a branch circuit when there also is a disconnecting device at the junction of the branch with the main circuit.

Use the recommendations of the Transformer Section of NEMA in selecting transformers. That means basing the rating on the standard 55 deg. C. temperature rise, taking advantage of average annual temperature of the cooling medium, which is less than 30 deg. C., and taking advantage of any instances where the average loading is below the peak (ELECTRICAL WORLD, June 13, 1942, page 59). It means also no spare transformers and use of three-phase transformers for three-phase loads, single-phase transformer banks for multiple single-phase loads.

Remember Scarcities

In specifying panelboards and similar equipment pick the type which uses the least amount of critical materials. Considerable development work is being done by manufacturers of electrical equipment of all kinds with the view to substituting non-critical materials. The idea is that this "war model" equipment should be specified whenever possible.

Finally, and perhaps most important, radical changes from established practices should be adopted where they will result in savings of critical material. This is the field where engineers, architects and contractors can freely use their initiative to contribute to the war effort. Redesign of bus ducts has saved appreciable amounts of critical materials. Pre-war bus designs generally called for complete housing and no ventilation. Normally, they were calculated on an ampere-per-square-inch basis. The current materials scarcities dictate open or screened bus installations wherever possible, normally designed on a temperature-rise basis. These redesign practices have enabled material savings as high as 50 percent.

℞ **TO FACILITATE the process of checking the many electrical plant layouts which flow through WPB—and a means, as well, of getting quicker action—it is always a good idea to submit a simplified one-line diagram for jobs of 1,000 kva. of main transformer capacity and up. This should be done if possible at the time the request is made for priority assistance, and always before materials are ordered. Have the drawing show the size and rating of transformers, disconnects and similar devices, wire, cable, bus and other major items of equipment, along with the principal blocks of loads (best estimated demand and type of load), distances of main runs or wire or bus and any other special or major items which would be helpful in checking the layout.**

Editorials

S. B. WILLIAMS, *Editor*

Notice to Subscribers

Readers of ELECTRICAL WORLD will observe that the "trim size" of this issue is slightly smaller than that of previous numbers. The reduction in size has been made to enable the publishers to meet an order of the War Production Board limiting the amount of paper that may be used in 1943. Subscribers will note, however, that no change has been made in size of type or in the amount of editorial content per page, but that a substantial saving in paper has been effected merely by trimming the margins.

The publishers have adopted the new size as a war measure and as a contribution to the conservation of manpower and transportation facilities in the production and distribution of paper. Service to the reader has not been sacrificed and will be maintained as far as humanly possible in the face of the problems confronting all of us in our united efforts to win the war.

Remission of Taxes

FOR YEARS the utility industry has considered itself a tax collector. Regulatory bodies have looked upon utilities as tax collectors. Congressional taxing bodies, however, have an entirely different idea. To them utilities are tax payers.

It is necessary that one understand this viewpoint in order to get the proper perspective on the federal tax legislation. By taking this position Congress allows itself to be entirely oblivious to the purchase of private companies by municipalities. Since utilities are not considered to be collectors, such change in ownership, while involving a loss in federal revenues, is held not to mean a remission of taxes of the individual payer.

It is difficult for a layman to grasp entirely this kind of thinking. Obviously, if the municipality retained the private company rates, the individual consumer would be no better off in the payment of his electric bills, but in that case does not the city get the tax money that would otherwise go to the federal government? And, assuming the city government to be honest, would not that money be used to pay some of the city's bills? And would that not have an effect upon the individual taxpayer's city rate?

One can understand why Congress might want to stay as far away as possible from the competitive angle of public versus private operation. But, sticking the head in the sand isn't going to help any. By its very method of levying taxes on regulated utilities Congress aids and abets public ownership, and in so doing destroys the very thing it is trying to build up—sufficient revenues for the war, fairly assessed.

A tax bill that does not tax all utilities, other than those which are federally owned, equally so far as federal taxes are concerned is discriminatory. It places additional tax burdens on people in one community while remitting tax burdens in another.

While we do not question the integrity of the head of the Senate finance committee or any others who do not feel that competitive forms of ownership should have no consideration in the drafting of a tax bill, we do feel that they are definitely remiss in permitting a city to take war revenue away from the national government and return it in some form or other to its citizens.

If that isn't remission of taxes, if that isn't inequality in taxation, what would be?

Power Industry Gets Recognition

POWER has finally been recognized by WPB and the Administration as one of the fundamental raw materials of war. The establishment of J. A. Krug as wartime power czar was not done because the power industry needed a czar a dictate to it, but rather because power was so important that it needed a strong man to champion it in the upper councils—a man strong enough to prevent others from interfering and upsetting the war program.

The power branch of WPB was doing all right in its internal operations, but it wasn't strong enough to cope with other agencies that had a more direct route to the font of authority. By establishing the office of power director, electric power has been placed on a par with rubber, airplanes and ships as an almost independent war agency.

This is a most unusual action. Other independent agencies were created only when an industry was in greatly distressed circumstances and some extreme authority had to be given to a director to enable him to take necessaary drastic measures to assure adequate supply for military purposes. In this instance the supply of power has been adequate for all purposes, even civilian uses. It is the one raw material that since Pearl Harbor has not caused war production any headaches as to quality, delivery, adequacy or labor disturbances.

The power industry is fortunate that Mr. Krug was available for this post. He had previously shown

is ability as a strong administrator when head of the ower branch. The famous treaty with FPC is one vidence of his ability to work out coordinated pro-rams with other agencies. His return, after an absence f six months in priorities, not only brings power to a uch more important position in the war production rogram, but insures the industry, as much as anything an, that it can bend its efforts to the winning of the ar without fear that administrative jealousy or preju-ice will be permitted to interfere.

And so we like to think of the power director as a zar, not in the sense of being a dictator, but in the anner as used by Russians—"The Little Father." This n't a dictatorship, but a protectorate of all power, egardless of ownership, for and during the war.

A New Kind of a Report

CORPORATIONS are required to furnish annual reports f a financial nature, but perhaps this year a new kind of eport may be added to inspire the stockholders and the mployees—a report on the contributions toward the war ffort.

Such a report was recently made by the Cincinnati as & Electric Company on the first anniversary of the ttack on Pearl Harbor. It was a stimulation to read in imple, unadorned language what the company had done nd what the employees had done. The report gave a list f the men who had joined the armed force, spoke of re-war planning and its effect upon the company's ability o handle the load, the aids given to customer war pro-uction, food production, air raid protection, scrap ac-umulation, war bonds and a long list of employee extra-urricular activities.

This industry has something to be proud of in this ar—not only its own accomplishments but those of its en and women. Let's tell people about it.

Gas-Turbine Locomotive

ADOPTION by the Swiss Federal Railways of a gas-tur-ine electric-drive locomotive has marked a new field of enetration of the external combustion principle. Details ow released indicate that the turbine develops some 8,000 p., but that the air compressor takes 6,000, leaving only ,000 or so hp. output at the generator coupling. It con-umes about 1 lb. of fuel oil per horsepower at driver rims nd is credited with a thermal efficiency of better than 17 ercent at rated output and a cost (pre-war) per horse-ower twice as much as a steam locomotive but only hree-fourths that of a diesel-electric. Battery starting of he auxiliary diesel unit of 75 kw. and ignition of the urner in the combustion chamber take only four min-tes and acceleration of the main turbine to light load peed takes only four minutes more. Of course, no cool-ng water or boiler feedwater has to be carried; the com-ustion air cools the combustion chamber.

A recent *Brown-Boveri Review* article is also author-ity for the notice that Allis-Chalmers is proposing to build a 5,000-hp. gas-turbine locomotive with mechanical-hydraulic rather than electric transmission.

Stationary and mobile power generation have always benefited from the other's experience. Early electric power plants adapted their reciprocating prime movers on the evolving experience with industrial steam engines and rail locomotives. Later the diesel engine won acceptance in the power-generation field and subsequently it moved into transportation, where it has become a check on steam-road electrification. Now the gas turbine is getting a tryout in transportation service after receiving its bap-tism in the industrial process field. Although for central-station generation the gas turbine for the present is handi-capped by the degree to which auxiliary power is needed, it is becoming apparent that the time is getting closer when it, too, must be considered in station design. Maybe the eyes of the central-station field will have to turn toward transportation for part of the answer to whether the trend to future power generation will be to higher steam pressures and temperature or the mercury turbine or the gas turbine.

Utility Employees' Purchases of War Bonds

A VERY LARGE NUMBER of utility companies have qualified for the Minute Man Flag by the enrollment of 90 percent or more employees under the payroll deduction plan for War Bond purchases. A very small number, however, have reached a subscription of 10 percent of payroll.

To some people that inability to reach the 10 percent goal might seem like a sad state of affairs. But is it?

Utility employment has always been very stable and, for that reason, so have been wages. Temporary wartime employment, on the other hand, has been just the opposite and wages and pay checks have skyrocketed. To compare any participation by the latter with utility people would be most unfair because 10 percent of war workers' income would be only a small part of the increase in pay but recently received, while 10 percent of utility employees' income would have to come out of fixed earnings already used largely for fixed commit-ments. Ten percent of war workers' income comes out of surplus, but 10 percent of utility workers' income comes out of additional sacrifices which sometimes just can't be made.

This doesn't mean that a better job can't be done, and that every effort should not be made by manage-ment to stimulate greater bond sales. All we are trying to say is that participation by utility employees should not be judged on the same basis as workers who are getting large increases in income out of war work.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Gas, Not Power Is the Problem

THE biggest problems that lie ahead for WPB's new Office of Power Director are likely to be in gas—not in power. Realization of that prospect is coming as something of a rude jolt in many quarters in Washington.

This is not to say that there are no more problems or headaches ahead in power, nor that the job is done and can now be dropped from the war administration planning. Far from it. It is to say, rather, that the pattern of wartime power requirements and supply has been basically laid out and is materializing smoothly. The road ahead is clearly marked. With gas, on the other hand, particularly natural gas, the troubles are multiplying.

What is the picture as J. A. Krug becomes the nation's wartime utilities czar?

Electric power today is the one basic raw material in which there is no shortage—and in which no serious shortage portends. The annual peak period just passed produced a demand considerably below that which was anticipated. For Washington, that peak period provided the first real practical test of what wartime production requires from electric power.

Keeping on the Track

The answer, while it is not nearly so publicized as the similarly remarkable achievements of the railroads, is that the industry—counting in both public and private power operations—has shown it can do better than any of the estimates. The result is that in the minds of the war production administrators the job now ahead in power is essentially that of keeping the program which has been mapped out on the track—of keeping it from being shunted aside by the competitive pressures of other urgent segments of the war program. Rubber is a currently conspicuous example!

Because, of course, there is need for more power to match the scheduled increase in war production. And a need—minimum though it may be—of more materials for maintenance of present plant in sound condition. This additional need, however, for generating capacity, for transmission lines to make more effective use of installed kilowatts, for maintenance equipment and materials—all this has been mapped out since last summer and has stood the test of operating experience.

Plenty of Margin

What December's peaks showed WPB is that its program is heading in the right direction—that it is proportioned to give a margin of safety to absorb the inevitable shifts in production emphasis, that it has slack in reserves to carry unexpected new demands until new equipment could be programmed and delivered.

Therefore, the job in power is to see that the required components for expansion and maintenance are got to the industry when they are needed. Creation of the Office of Power Director with a seat on WPB's Requirements Committee, where the final determinations of materials allocations are made, gives power an equal voice with the other contenders already represented on this "jury." Such representation makes it possible to insist that the schedules already worked out for power are kept.

The gas situation, on the other hand, hasn't matured as has electric power. For many months gas was a virtual orphan in the war administration. This winter gas supplies have become inadequate in several areas, and the likelihood is that the situation will become acute by next winter. The need now is for a comprehensive programming in gas comparable to what has already been done in power.

Here is recognized to be Krug's big immediate task, duplicating what he developed and Herbert S. Marks carried on through the first major test in power. This is a job for the technician, a job of determining first what must be done and then of working out how to get it done by sandwiching schedules for materials and equipment deliveries into the war schedules without upsetting the applecart.

The gas job is almost wholly one of transmission and distribution—of getting more effective use out of facilities which now exist. Production of natural gas is not a bottleneck; the trouble is that great surpluses exist which cannot be laid down in far distant areas where supplies are becoming inadequate and only the barest skeleton of new facilities can be afforded. It may be easier to come up with a solution simply calling for vast additional transmission capacity, but the steel and the compressors and the dozen and one other essentials just aren't there.

Authority Clear

Because the problem is at the transmission and distribution level, jurisdiction over this gas matter falls to WPB, which means to WPB's Office of Power Director. The division of authority in gas is clear. Authority over production of natural gas is vested with Petroleum Coordinator for War Ickes, presumably because of its close association with oil; authority over transmission and distribution of gas and of manufacture of artificial gas belongs to WPB, doubtless because of its close affiliation with electric utilities in many regions.

There are many similarities to Krug's job ahead to the job already plotted in power. In both fields, for instance, the task is to get the most effective use of the available supplies and facilities. This means integration, and pooling, with probably some increase in pipe lines to move surpluses.

The pattern for gas curtailment already exists—in WPB limitation orders tailored after the L-94 order for power. But the gas integration and pooling programs are, by comparison with power, in their infancy

NEWS OF THE WEEK

Manpower Board Revises Essential Utility Jobs

List of 86 occupations cut to 51, but definitions broadened — Sales, promotional, legal, tax, clerical, insurance and rate men dropped from list of jobs meriting deferment

War Manpower Commission and Selective Service have reaffirmed in a revised Occupational Bulletin No. 9 the essential nature of most of the electric utility occupations which were held to be in support of the war by the latter agency last Spring.

Non-Operating Jobs Dropped

Although the list of 86 occupations which Selective Service originally considered cause for occupational deferment (ELECTRICAL WORLD, June 6, 1942, p. 3) has been reduced to 51, broader WMC definitions for a number of categories make the amended list cover most of the original jobs. One notable deletion, being applied to all industries, is that of managers or assistants principally concerned with sales, promotional, legal, tax, clerical, insurance, rate structure and other non-technical and non-operating activities. Technical and operating management jobs remain in the latest issue of the regulation.

Employees holding the jobs listed in the bulletin are eligible for consideration for 2A occupational deferments when their draft numbers come up. All classification decisions rest with local boards, which are expected to use the bulletin as a guide and to consider the individual's training and skill, the training and skill required in his work, the availability of replacements and the time required to qualify a replacement. All jobs require at least six months training.

Listing of the power industry as being in support of the war effort has meant that all utility employees with dependents under the draft act have been eligible for 3B classification since last June.

This status is somewhat improved by WMC's action this week in withdrawing eligibility to 3B classification and all deferment after April 1, for 29 occupations regardless of the employer's business and deferment for all workers in 19 manufacturing, eight wholesale and retail and nine service activities.

None of the businesses listed are connected with utility operations. The individual occupations from which 3B will be withdrawn on April 1 include such jobs as charmen and cleaners, elevator operators and starters (excluding industrial freight elevators related to production), errand, messenger and office boys, porters, chauffeurs, waiters and busboys, etc. Meter readers, general accountants and similar utility occupations not eligible for 2A occupational deferment still are eligible for 3B if they have dependents.

In general, 3B men have been scheduled for call after 3A men of similar domestic situation, but this new action is intended to channel all eligible men in the listed categories, regardless of their family status, either into war jobs or into military service before 3B men are called.

The amended bulletin was issued after considerable consultation between WMC and Selective Service, during which it was broadened to include heating, water supply and illuminating services. The Council of Electric Operating Companies offered numerous suggestions to WMC's technical committee during the revision. Currently, the council is consulting with the committee in preparation of an unofficial comparison of the job titles in the new and old lists. This comparison will be available to the industry soon.

WMC emphasized that the bulletin will not necessarily retain its present form for the duration, but will be subject to reinspection and redefinition as the manpower picture changes.

Full List of Titles

The full list of occupational titles in the revised Bulletin No. 9 follows:

Audit accountant (those assuming extensive responsibility for examination and verification of accounting records and preparing comprehensive financial reports; not those performing routine auditing duties under supervision); armature winder (those who install, repair and wind coils to motors, generators and transformers); auxiliary equipment operator (only those who actually control and adjust boiler and turbine auxiliary equipment; not oilers and wipers).

Also, bacteriologist; batteryman (large emergency storage batteries), blacksmith, maintenance; boiler operator; boilermaker, maintenance; booster-pump operator; bricklayer, maintenance refractory; by-product operator, gas; cable splicer (those who install, repair and maintain overhead or underground power cables); carpenter, maintenance; chemist; chief operator, water purification or softening; crane operator; district serviceman (electric power); draftsman, engineering; driller, water well.

Also, electrical tester; electrician, system or plant; engineer, professional or technical (those actually engaged as engineers in the operating and research phases of the company, regardless of educational background); engineer, turbine or diesel; foreman (those actually engaged in supervisory duties, who exercise independent judgment and assume extensive responsibility; does not include labor gang foreman); gas equipment and control man; gas maker.

Also, heavy mobile equipment operator,

maintenance and construction (those who operate and make repairs to ditching machines, hole diggers, pole raising devices, winches, etc.; does not include truck drivers or tractor drivers); inspector (those responsible for inspection duties involving operating efficiency, safety, specifications on construction and to insure uninterrupted service); instructor, training program (only those engaged in occupations in the list who because of skill and experience are teaching others in an established training program).

Also, lead burner; lineman; load dispatcher, power or gas; machinist, maintenance; manager, employment and personnel; mechanic, maintenance; meter repairman, gas and water; patrolman, transmission line; pipe fitter, maintenance; purification operator, gas; pusher man; radio technician; rigger, construction; rigger supervisory, underground cable; sheet-metal worker, maintenance; storekeeper, chief (those responsible for the operation of a store, department or major subdivision; not stock clerks, bin clerks, stock-handlers); substation operator.

Also, superintendent or manager, division, district, plant and department (those who are actively engaged in supervising directly or through subordinates various technical or operating departments; covers those assistants who are directly responsible to managers on a division or district level for efficient functioning of technical or operating departments; does not cover managers or assistants concerned primarily with sales, promotional, legal, tax, clerical, insurance, rate structure and other non-technical or non-operating activities); switchboard operator, power; system operator (load dispatcher), tree trimming supervisor, overhead power lines; welder, all around.

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WPB Cuts Valve Types Produced

A WPB simplification order—L-252—will reduce the number of types of gate, globe, angle, cross and check valves from 4,079 to 2,504 for the duration to save an estimated 1,900 tons of copper and 4,340 tons of alloy steel annually. This is 9 percent of the copper and 27.5 percent of the steel normally used in valve production.

Valves are classified in the order by design, materials used, pressure and size. Cross valves and brass or iron angle check valves are completely eliminated; pressure classes reduced from 18 to 12; sizes materially reduced. Use of brass, regardless of pressure, is limited to sizes of two inches or less and the union bonnet rings and stuffing box packing nuts for brass valves are restricted to malleable iron or steel.

Steel valves in pressure classes of 150, 600, 900 and 1,500 psi. are to follow ASA and American Petroleum Institute specifications. Iron valves will come in five pressure classes, from 25 to 300 psi. and in 29 sizes from ¼-inch to 72 in.

Power Commission Proposed for Omaha

Measure aimed at acquisition of Nebraska Power Co.

A bill to create a power commission in Omaha, with authority to acquire and operate the Nebraska Power Co., sole remaining privately managed utility in the state, has been introduced in the Nebraska Legislature. Under the proposal the commission would have the power to acquire electric properties by negotiation, lease or condemnation, or buy common stock of private utilities if a controlling interest were obtained.

The bill would remove the present authority of the Metropolitan Utilities District of Omaha, which has supervision over gas and water supply, to take over and operate any electric utility the city might acquire. Chief reason for the measure, according to Senator Sidney Cullingham of Omaha, sponsor of the bill, is to safeguard the interests of Omaha in view of dissolution orders of the Securities and Exchange Commission brought against American Power & Light Co., the parent. American is a major sub-holding unit in the Electric Bond & Share Co. system.

Last May the Consumers Public Power District of Columbus, Neb., offered to buy Nebraska Power for $40,680,000, but J. E. Davidson, president of the company, said that the property was "not for sale" (ELECTRICAL WORLD, May 30, 1942, page 130; July 4, 1942, page 10) without the consent of the city of Omaha. The new bill would make the Mayor of Omaha responsible for the appointment of the proposed six-man power commission of Omaha.

A measure has been prepared for introduction to the Colorado Legislature also, for creation of a power district in the state which would take over and operate private utilities in the area.

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Court Recognizes Two Employee Groups

The Supreme Court of Pennsylvania has sustained the Pennsylvania Labor Relations Board in a finding that the hourly rated employees of the Colfax power station of the Duquesne Light Co. constitute a separate unit for the purposes of collective bargaining. Practical effect of the decision is to establish two separate bargaining units for the operating hourly rated employees of the company. One unit consists of the Colfax station employees, while the other unit consists of all the hourly rated employees at the other power stations and operating departments of the company.

The decision of the state Supreme Court was based on a finding that there was sufficient evidence in the record to justify the Labor Relations Board in its finding and that the question of the weight to be given the evidence was for the labor board. Commenting on the decision, E. C. Stone, vice-president and general manager of Duquesne Light Co., said that it is an indication that in Pennsylvania, as in the federal courts, the decision of an administrative agency such as the Pennsylvania Labor Relations Board will not be disturbed if there is any legal evidence on which the decision can be based.

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Refrigerator Repair Priorities Revised

Complete revision of the priorities procedure for emergency repair of industrial and commercial refrigerating and air-conditioning systems is made in a re-issue by WPB of Order P-126. Priority ratings made available for materials and parts are considerably higher than previously have been authorized.

Emergency repairs for continued operation of processing, transportation or storage of food for the Army, Navy, Maritime Commission or War Shipping Administration, for cold storage or commercial ice houses, for meat-packing establishments under Government inspection, for "dry blast" in blast furnaces and for war production plants may now be made on rating AA-2X, instead of A-1-a. For emergency repair of systems used in commercial processing of foods, for preserving blood plasma, pharmaceuticals, etc., the new order offers an AA-3 rating, instead of A-3. An AA-4, instead of an A-8 rating may now be used for materials for inventory, for retail food establishments and for other essential uses excluding domestic and "comfort" air conditioning.

None of the ratings made available may be used except by individuals or firms having an "emergency service agency's certificate." This is obtained by application to WPB on Form PD-399 for commercial repair houses and on Form PD-471 for those performing their own repairs.

A new provision of the order requires the "turn-in" of a broken part when a new one is supplied on priority ratings. Another provision limits inventories of repair parts to the inventory held on December 31, 1941, or the end of fiscal year in 1941.

Rules OPA Evidence on Rates Must be Heard

District of Columbia Federal District Court decision in Washington Gas Light case requires government evidence on inflationary trends be submitted to regulatory bodies

Government evidence on the inflationary trend which an increase in utility rates during wartime may portend must be fully heard by state and local regulatory agencies under the price stabilization law of October 2, 1942, the District of Columbia Federal District Court has ruled.

Remands Case to Commission

The ruling supports an order by Judge F. Dickinson Letts remanding to the District of Columbia Public Utilities Commission for further hearing the case involving a $200,000 increase in Washington Gas Light Co. rates under the 1935 sliding scale rate procedure (ELECTRICAL WORLD, October 24, 1942, page 3). Because the case had been started prior to passage of the law, the commission excluded evidence offered by the Office of Price Administration both on the inflationary aspects of the increase and on the company's rate base.

Judge Letts did not touch directly upon the issue of whether OPA must be allowed to present evidence covering the full range of rate-making procedure, including valuation, depreciation, etc., as sought by the government. But he did rule that the "sliding scale" agreement is not a contract, "certainly not one which binds the public." Instead, he said the arrangement is one which must give way to public policy and to Congressional enactment which expresses that policy.

"Any arrangement before October 2, 1942, lacks public approval and must give way to Congressional edict," he said. "The basic principles of the arrangement and other factors which inhere in the question of inflation and of fairness and justice are open for determination.

"Such question may not be dismissed, but must be met, and the only way to meet it is to hear fully such evidence as the President's representatives may produce and otherwise make a searching investigation in the light of present economic and war conditions to determine whether the proposed increase in rates will be inflationary in character and so contrary to the declared policy of Congress."

The increased gas rates, averaging 3 cents monthly to individual customers, have been in effect since November 16, 1942. Utility lawyers indicated they intended to appeal from the decision to the Circuit Court of Appeals.

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Revise Fluorescent Metal Restrictions

Additional restrictions in the weight of metal which may be used in the manufacture of fluorescent lighting fixtures are set forth in a new revision of Order L-78 issued by WPB.

The new order becomes effective in two bites. After Feb. 9, use of metal is prohibited in the manufacture of shields, louvres or baffles except in the minimum amount required to join them to the reflector. Reflectors previously were banned from the metal field. Exceptions permit metal construction of shields, louvres and baffles for use in hazardous locations as defined in the 1940 National Electrical Code, for use with 400-watt or 3000-watt mercury tubes or bulbs, for Navy shipboard use and for mechanic's lamps.

Permissable Weights

After May 4 the following is the permissible weight of metal in various types of lamps and fixtures: For use with two or three 40-watt hot cathode tubes or bulbs, not more than 3 pounds of ferrous metal; for two 100-watt hot cathode tubes and bulbs, not more than 4 pounds of ferrous metals; for two or three continuous parallel rows of 40-watt hot cathode tubes or bulbs, not more than 3½ pounds of ferrous metal for each four linear feet of fixtures, and for two parallel rows of 100-watt hot cathode tubes or bulbs, not more than 4½ pounds of ferrous metal for each five linear feet of fixture. In all instances ballast, hanging and suspension devices are not counted as part of the fixture.

The new L-78 also revises the definition of industrial fluorescent fixtures to specify that an office or drafting room is not an area in which manufacturing, assembling or other industrial functions are performed. Several other clarifying amendments to phraseology also are incorporated in the new order, but no changes are made in the provision regulating disposition of frozen inventories.

FOSTER WHEELER STAR—There was rejoicing at the Carteret plant of the Foster Wheeler Corp. recently when Admiral H. A. Wiley notified the company that the Navy had awarded it a star for excellence in production at the end of six months following receipt of the Navy "E." In addition to receiving the Army-Navy "E" there was the award of a Minute Man flag from the U. S. Treasury for employees' bond purchases. At the ceremonies were H. S. Brown, president; William Lonsdale, vice-president; and Senator John Toolan of New Jersey

Power Pool Testifies on DPC Aluminum Contract

FWA authorized to intervene in proceedings into rates charged by Southwest company — Reasons for changes in new contract outlined by operating company executives

Reasons why changes were made in the new proposed contracts offered the Defense Plant Corporation, to replace the original contract, signed December 16, 1941, with the Arkansas Power & Light Co., were explained at the opening of last week's continued hearings being conducted by the Federal Power Commission into rates charged the DPC by the Southwest power pool for power for the Lake Catherine aluminum plant (ELECTRICAL WORLD, December 26, 1942, page 55; January 2, 1943, page 5; January 9, page 52; January 23, page 130; January 30, page 7). Additional testimony during the week's hearings brought out the fact that the Federal Works Agency had intervened in the proceedings; that the only firm power supplied the aluminum plant comes from the REA-financed Ark-La cooperative; that the Oklahoma and Texas pool members supply most of the pool's power requirements, the other companies having little surplus available; that the pool companies' holding units have representatives on the pool's operating committee; that demand fees are waived by pool members, and that three of the pool members have made plans for interconnection with four other utilities not at present members of the Southwest pool.

Cites Obsolete Clauses

At the close of four days cross-examination, Frank M. Wilkes, president of the Southwestern Gas & Electric Co., told trial lawyer Lambert McAllister of the FPC that clauses of the old contract which were obsolete were eliminated in the proposed new contract. The new contract reduced the minimum demand on the power pool from 65,000 kw. to 40,000 kw., the charges remaining the same—$2 per kw. per month demand and 4 mills per kw.-hr. for energy. The reduction in demand was asked by the DPC because it increased its own generating plant to carry two pot-lines instead of one, as had been planned at the time the original contract was made. Among the changes in the new contract was the elimination of an offer for the pool to transmit public power over pool lines without profit, except line losses. Mr. Wilkes explained that at the time the offer was made it was to prevent the spending of tax money on the $3,700,000 Ark-La co-operative line. When the line was authorized and built, he said, the need was eliminated, since it applied to the Grand River Dam power, now transmitted over the Ark-La line. The power pool was formed for the specific purpose of supplying the aluminum plant load, Mr. Wilkes pointed out, and reserves made available for firm power for this purpose were not released to serve other industrial loads of the individual companies.

Discussing the Norfork-Ozark Beach transmission line which was started by the Arkansas Power & Light as a part of the pool to bring the Empire District Electric Co. into the pool, Mr. Wilkes said he agreed to inclusion of this line because at the time it was planned "the north connection would be necessary if we were going to furnish 100,000 kw." WPB halted construction of the line in April, 1942.

Testifies On New Plant

In the following day's session C. S. Lynch, executive vice-president of the Arkansas utility, testified that priorities for the company's new 30,000-kw. steam generating plant in the "sour gas" fields of south Arkansas were filed early in 1942 because load estimates indicated it would be needed by the middle of 1943. Mr. McAllister had introduced a telegram sent by Mr. Lynch in December, 1942, regarding a predicted power shortage and sought to establish that in one month Mr. Lynch was denying there was to be a power shortage and the next month was seeking to show there would be one in his application for priorities. Mr. Lynch explained that his telegram was based on an Office of Emergency Management news release and that his telegram stated that no power shortage had developed up to that time.

Mr. Wilkes resumed the stand the following day for redirect examination. He sought to show that while the Ark-La co-op was signing a contract for 32,500 kw. of firm power from the Grand River project in Oklahoma, it had a commitment from the Grand River dam for only five months for power. During the day's hearing, trial examiner Frank A. Hampton of the FPC announced that the commission had authorized the Federal Works Agency to intervene in the proceedings. The FWA has supervision of the Grand River dam and Douglas Wright, manager of the dam project was expected to testify.

Efforts of Mr. Wilkes to introduce into the record the FPC's definition of firm power met with failure when Mr. Hampton sustained an objection of Mr. McAllister. Richard Arnold, attorney for the Southwestern Gas & Electric, said he would try to get the definition into the record.

Charges Attempt to Renegotiate

Mr. Lynch went back on the stand the following day and testified that the Arkansas Power & Light Co. would not have offered a better rate for power to the aluminum plant had it known at the time it made its original contract that the proposed steam generating plant at the aluminum mill would not be built. This testimony brought forth a heated discussion, in which the pool's chief counsel, Eugene P. Locke of Dallas, charged that Mr. McAllister was attempting to renegotiate a contract for the plant's power supply. McAllister had questioned Mr. Lynch as to what rates might be charged at the end of the two-year period of the contract. Mr. Locke objected and the question of the present status of the contract between the DPC and the power pool brought from trial examiner Hampton the remark that "the present exact condition of the contract between the Arkansas Power & Light and the DPC is uncertain."

Ark-La Voltage Insufficient

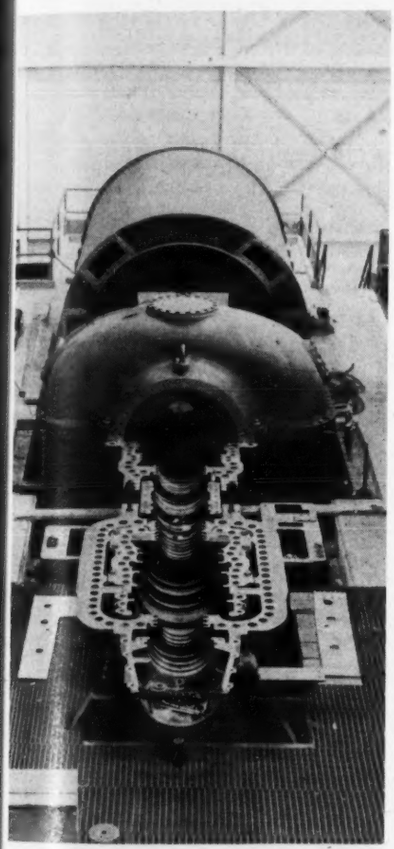
It was further brought out in Mr. Lynch's testimony that tests have shown that the Ark-La co-op's power supply from Grand River, over a 200-mile transmission line, will not prove sufficient from a voltage standpoint for the aluminum plant without assistance from the Southwest power pool. It is costing between $900 and $1,000 a month to maintain the proper voltage on the common bus at the Lake Catherine plant, which is supplied by both Ark-La and the pool. Mr. Lynch explained that the generators at the power company's Remmel and Carpenter Dam, near the aluminum plant, are floated on the line and serve as condensers to help hold up the voltage at the plant. In August, 1942, he said, a test was made with Ark-La supply coming to the common bus independent of the pool and it was shown conclusively that the voltage was not high enough to meet requirements for aluminum production.

Mr. McAllister questioned Mr. Lynch at length on his use of the term "business-managed utility companies,"

and sought to get into the record testimony to show that such "business-managed" companies included those which have write-ups in their plant accounts.

M. F. Gill, president of the Kansas Gas & Electric Co., and F. E. Smith, vice-president of the Nebraska Power Co., both limited participants in the power pool, were cross-examined the following day. Both testified that some 25,000 kw. of reserve was released for the two companies by the interconnection, and that some additional capacity was made available through diversity.

P. A. Lasley of the Arkansas Department of Public Utilities was scheduled to take the stand when the hearing reconvened the following week. Already the transcript in the hearing occupies more than 2,000 pages and 85 exhibits.



INSTALLATION of a second 40,000-kw. turbo-generator in the Oleum steam plant of Pacific Gas & Electric Co. is nearing completion. The G.E. machine is a duplicate of three similar units installed in plants adjacent to oil refineries on San Francisco Bay during 1941 and 1942. The turbine is a tandem-compound machine consisting of a high-pressure, non-condensing 3,600-r.p.m. turbine coupled to a single-flow, low-pressure condensing unit. Generator is hydrogen cooled

SEC Stock Ruling is Rejected by Supreme Court

First decision limiting scope of commission's authority holds purchase of stocks by company officers during corporate reorganization is legal transaction

In one of the first decisions limiting the scope of the Securities and Exchange Commission, the U. S. Supreme Court last week held, in the case of the Federal Water Service Corp., that purchase of preferred stock of a public utility holding company by its officers and directors, while the company is undergoing reorganization, is a legal transaction. The four-to-three decision, with Justice Frankfurter writing the majority opinion, set aside an SEC order holding that stock in the company, purchased by its officers, could not share on the same basis with stock held by others during corporate reorganization proceedings.

No Fraud Involved

The Securities and Exchange Commission had previously ruled that preferred stock bought by officers and directors of the Federal Water Service Corp., a New York holding company engaged in merger proceedings with two affiliates, Utility Operators Co. and Federal Water & Gas Corp., could not be converted into stock of the reorganized company, but that it could be surrendered at cost plus 4 percent interest. No issue of fraud was involved, but the commission had ruled that the purchases violated a "duty of fair dealing" on the part of those intrusted with the management of the company.

The SEC, the court said, might be empowered to establish broad rules applying to reorganization cases, but said the court's opinion was based specifically on the case before it.

"As the commission concedes here, the courts do not impose upon officers and directors of a corporation any fiduciary duty to its stockholders which precludes them, merely because they are officers and directors, from buying and selling the corporation's stock," the court said. "Determination of what is fair and equitable calls for the application of ethical standards to particular set of facts . . . Congress certainly did not mean to preclude the formulation by the commission of standards expressing a more sensitive regard for what is right and what is wrong than those prevalent at the time the Public Utility Holding Act of 1935 became law.

"But the commission in this case did not proffer new standards reflecting the experience gained by it in effectuating the legislative policy. On the contrary, it explicitly disavowed any purpose of going beyond those which the courts had theretofore recognized. Since the commission professed to decide the case before it according to settled judicial doctrines, its action must be judged by the standards which the commission itself invoked. Judged by those standards—those which would be enforced by a court of equity—we must conclude that the commission was in error in deeming its action controlled by established judicial principles."

Justices Black, Reed and Murphy dissented from the opinion and Justice Douglas, former SEC chairman, took no part in the case. In his dissenting opinion Justice Black contended that the officers and directors paid $328,346 for the 12,407 shares of preferred stock purchased and then submitted a reorganization plan under which the stock would have a book value of $1,162,431. "To permit their reorganization plan to put them in the same position as the old stockholders," he wrote, "gives to these fiduciaries an unconscionable profit for trading with inside information."

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SEC Approves Sale of Minnesota Units

The Securities and Exchange Commission has approved the sale by Minnesota Utilities Co. of its Pine River District electric properties in Cass and Crow Wing counties to Minnesota Power & Light Co. for $185,000 in cash, plus $15,000 for materials and current assets, subject to certain adjustments.

Minnesota Utilities proposes to employ the cash proceeds from the sale in partial payment of its note indebtedness to its parent, American Utilities Service Corp., which will deposit the payment with its trustee, Continental Illinois Bank & Trust Co. of Chicago. American, in turn, will use the $185,000, together with other funds, for the purchase of a maximum of $200,000 of its collateral 6 percent bonds, series A.

Urges Acquisition Of N. Y. Power Lines

Completion of a power line between Massena and Taylorville, N. Y., now being used to supply war plants, was described as the opening step in an opportunity for acquisition of a publicly owned state-wide transmission network to market hydro-electric power developed on the St. Lawrence River, in the annual report of the New York Power Authority, submitted last week to Gov. Thomas E. Dewey and the New York Legislature. The federal government, the report said, has alloted $15,000,000 for interconnection with a Pennsylvania-New Jersey power pool and to extend the line to New York City.

"This presents to the state an opportunity," the report said, "to acquire or to obtain the use of additional transmission facilities and thus provide the state's power project in the International Rapids section with an outlet entirely free from domination and control by monopoly interests."

The report's recommendation is of more than passing interest in view of the fact that the power line was authorized at the last session of the Legislature only after a bitter argument. Proponents of the line presented it as a necessary defense project to supply the war plant. Opponents claimed it might pave the way for post-war public power development.

The report commended Governor Dewey's recommendations to the Legislature authorizing the state to collect "an equitable rental" from the Niagara Falls Power Co. for diversion of Niagara River water for power purposes. The increased rental, they pointed out, however, would eventually be placed on the consumer and the real solution to the problem lay in the state's regaining title to power developments in the area.

See Extensions for 30,000 Dairy Farms

The Department of Agriculture, in an official release, estimates that between 30,000 and 40,000 livestock, dairy and poultry farms will obtain electric service under WPB's newly established rural "whisker" extension program (ELECTRICAL WORLD, January 16, page 5).

This estimate parallels that made by former acting Director Herbert S. Marks of WPB's Power Division in an address prepared for delivery at the recent convention of the National Rural Electric Co-operatives Association in St. Louis (ELECTRICAL WORLD, January 30, page 9). In his talk Marks bluntly pointed out that other estimates of the extent of the program—some press accounts said that the program envisaged electrifying 20,000 farms monthly, the pre-war REA rate—were incorrect.

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Change Date of A.I.E.E. Symposium Meeting

The fourth lecture, "Guided Propagation" by Dr. S. A. Schelkunoff, of the Symposium on Ultra-Short Electromagnetic Waves, sponsored by the Basic Science Group of the New York section, American Institute of Electrical Engineers, will be held on February 17 instead of February 10.

This change was made to avoid a conflict with the joint meeting of the New York sections of the A.I.E.E. and I.R.E., on February 10, at which Brig.-Gen. F. E. Stoner, director of the Army Communications Division, U. S. Army Signal Corps, will speak on "The United States Army Signal Corps."

MEETINGS

Southeastern Electric Exchange—Engineering and Operation Section, Henry Grady Hotel, Atlanta, Ga., March 25-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Previously Listed

Edison Electric Institute — Accident prevention committee, Hotel Gibson, Cincinnati, Ohio, February 8-9; transmission and distribution committee, Wm. Penn Hotel, Pittsburgh, Pa., February 11-12. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

American Society for Testing Materials—Committee week and spring meeting, Hotel Statler, Buffalo, N. Y., March 1-6. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Electrochemical Society — Spring meeting, Hotel Roosevelt, Pittsburgh, Pa., April 7-10. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

Midwest Power Conference—Palmer House, Chicago, Ill., April 9-10. Stanton E. Winston, conference director, Illinois Institute of Technology, Chicago, Ill.

Missouri Association of Public Utilities—Annual business meeting, Elms Hotel, Excelsior Springs, Mo., April 16-17. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

National Electrical Manufacturers Association — Spring meeting, Palmer House, Chicago, Ill., April 20-23. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

North Central Electrical Industries—Annual all-industry conference, Radison Hotel, Minneapolis, Minn., April 26-27. Wm. A. Ritt, secretary-manager, Foshay Tower, Minneapolis, Minn.

American Society of Mechanical Engineers — Spring meeting, Hotel Black Hawk, Davenport, Iowa, April 26-28; semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Missouri Valley Electric Association—Annual engineering conference to be held in conjunction with meeting of 7th District American Institute of Electrical Engineers, Continental Hotel, Kansas City, Mo., April 28-30. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

FPC Approves S.C.E. Write-Down Program

The Federal Power Commission has announced its approval of plans of the Southern California Edison Co., Ltd., for disposition of more than $11,000,000 established as excess charges over original cost in the company's studies for reclassification of accounts and original cost of electric plant. As of January 1, 1937, the effective date of the commission's uniform system of accounts, the company's plant accounts included the amount of $4,775,345 in Account 100.5 (electric plant acquisition adjustments), and $7,174,188 in Account 107 (electric plant adjustments). These amounts have been reduced by subsequent retirements of property to $3,927,082 and $7,172,891, respectively, as of December 31, 1942.

Southern California proposes to dispose of the $7,172,891 remaining in Account 107 as follows:

To Account 200 (common stock) $5,966,200. The company plans to state its common stock at the amount received therefor in accordance with the California law and this will result in an adjustment in the present book amount.

To Account 250 (reserve for depreciation) $535,516, representing depreciation accruals on amounts established in Account 107 and underpriced retirements.

To earned surplus $671,174, being the balance of the amount established in Account 107. The company proposes to dispose of the $3,927,082 remaining in Account 100.5 by amortizing the amount over a 15-year period through Account 505 (amortization of electric plant acquisition adjustments).

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Peoples Light Files Voluntary Recap Plan

Peoples Light & Power Co. has filed with the SEC a voluntary plan for corporate simplification under Section 11 (e) of the Holding Company Act, providing for reorganization, divestment of control, redistribution of voting power and other transactions to comply with the provisions of Section 11 (b) (2) of the act.

Peoples Light & Power Co. now consists of a single holding company owning all the voting securities of five subsidiaries doing business in Texas, California, Oregon, Idaho, Nevada and Wyoming. The plan proposes capital adjustments which would give the preferred-stock holders 95 percent of the voting power, class A stockholders 2.1 percent and class B 2.9 percent.

Dark Days Keep Output Curve Up

A combination of generally overcast weather, the effects of national "wartime" and the fact that industrial production has shown no signs of slackening off in the past three weeks have all contributed to an unprecedent rise in the output curve during that period, when declines are customarily the order. The amount of electric energy distributed by the light and power industry for the week ended January 30 again flirted with the four billion kw.-hr. mark—the actual figure being 3,976,844,000 kw.-hr. For the week previous the figure was 3,974,202,000 kw.-hr. and for the January 16 week was 3,952,479,000 kw.-hr. Figures for the latest week bring the percentage of increase to 14.7 percent over the corresponding week in 1942, according to the Edison Electric Institute.

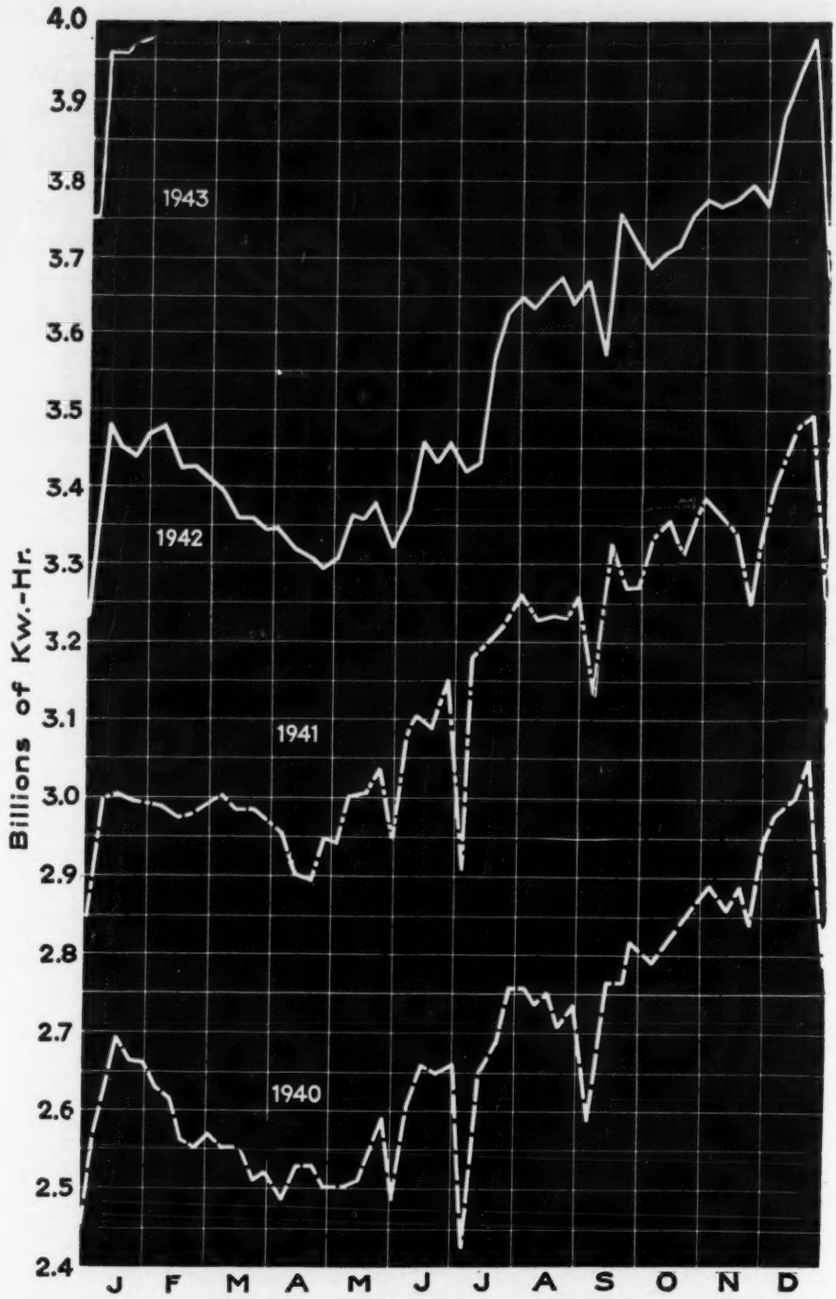
The New England, mid-Atlantic, Central Industrial, Southern and Pacific Coast areas fell off slightly in percentage increases over '42 figures from the week previous. Slight gains were registered in the Rocky Mountain and West Central areas. The Pacific Coast continues to lead the country.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Jan. 30	3,977	Jan. 31	3,468	Feb. 1	2,991
Jan. 23	3,974	Jan. 24	3,440	Jan. 25	2,996
Jan. 16	3,952	Jan. 17	3,450	Jan. 18	3,013
Jan. 9	3,952	Jan. 10	3,472	Jan. 11	3,002
Jan. 2	3,780	Jan. 3	3,289	Jan. 4	2,816
1942		1941		1940	
Dec. 26	3,656	Dec. 27	3,234	Dec. 28	2,757
Dec. 19	3,976	Dec. 20	3,495	Dec. 21	3,052
Dec. 12	3,937	Dec. 13	3,476	Dec. 14	3,003
Dec. 5	3,883	Dec. 6	3,415	Dec. 7	2,976
Nov. 28	3,766	Nov. 29	3,339	Nov. 30	2,932

Percent Change from Previous Year

	Week Ending		
	Jan. 30	Jan. 23	Jan. 16
New England	+ 3.6	+ 7.0	+ 3.7
Mid-Atlantic	+ 7.7	+ 9.6	+ 7.1
Central Industrial	+12.2	+12.6	+12.2
West Central	+15.6	+14.3	+12.4
Southern States	+20.1	+21.2	+21.4
Rocky Mountain	+13.8	+11.0	+13.5
Pacific Coast	+29.6	+30.6	+27.0
Total United States	+14.7	+15.5	+14.5



Alabama Power Expansion Proceeds

Alabama Power Co., Birmingham, is arranging expansion and improvement program in 1943, covering expansion in steam-electric generating stations now in progress, extensions in transmission and distributing lines, power substations, switching stations and other facilities, covering war-related activities. Budget will approximate $4,700,000 for period.

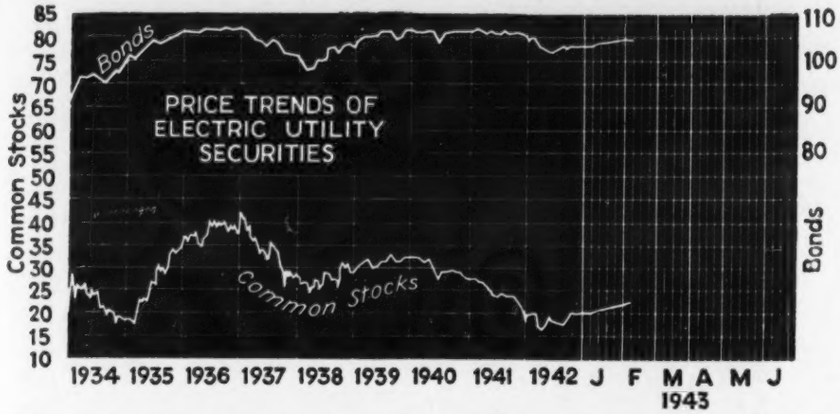
Work is in progress on addition to Chickasaw generating station, near Mobile, with installation of new 40,000-kw. turbine-generating unit to increase rating to 80,000 kw. Completion is scheduled early this year. Similarly work is under way on extensions in Gorgas power plant, with installation of a 60,000-kw. turbine-generator and accessories to increase plant capacity to 190,000 kw.; it is expected to complete this work in the summer of 1943. Work is under way on a coal mine development in the vicinity of the last noted plant, to be equipped for an annual output of about 350,000 tons. During the coming year the company will relocate several existing transmission lines.

December Average Daily Output Hits New High

Average daily production of electric energy for public use in December hit a new all-time high—603,255,000 kw.-hr., an increase of 3.5 percent over average daily production during the previous month, according to the report issued by the Federal Power Commission.

Electric energy produced for public use in December totaled 17,373,750,000 kw.-hr., an increase of 13.0 percent over production in December, 1941. Production by waterpower in December amounted to 6,086,886,000 kw.-hr.

Utility Stocks Improve; Bonds Drop



Utility stock prices continued their upward trend during the past week. "Electrical World" index advanced to 22.4 from 21.9 the previous week; last year, 19.8. There were few changes in bond prices, the index dropping to 104.5 from 104.6; last year, 104.8

Stockholders Enter Portland Hearing

A new element in the form of a preferred-stockholder committee will be injected into the SEC's hearing of Portland Electric Power Co.'s. financial reorganization when the hearing resumes in Portland, Ore., February 15. The committee, newly reorganized to represent the 13,000 preferred-stock holders of PEPCO, many of them local people, met January 20 to plan its campaign to protect the stockholders' interests. The hearing will be a continuation of that adjourned from Philadelphia last November.

First step taken by the committee was a request by its attorneys that the SEC subpoena Dr. Paul J. Raver, Bonneville Administrator, and William Ditmar and D. R. Marlett of the Bonneville administration, together with all correspondence, letters, telegrams and other written communications bearing on the Portland General Electric Co. properties. (Portland General Electric Co. is the chief subsidiary of Portland Electric Power Co.) The subpoena also asks that all correspondence between Dr. Raver and his associates and any member of Congress "pertaining to the promulgation of public ownership" be produced at the hearing. Finally it is requested that "all files, memoranda and data of the Bonneville administration pertaining to the potential further development of the production of electric energy at (1) Bonneville, (2) Grand Coulee and (3) any other proposed projects in the states of Oregon, Washington or Idaho that would affect the supply of electric energy in the Portland area" be produced.

J. F. Ulrich, real estate dealer of Salem, Ore., is chairman of the stockholders' committee. Paul E. Gurske, president of the State Federation of Labor, Portland, is vice-chairman, and Joseph R. Gerber of the Jos. R. Gerber Advertising Agency, Portland, secretary and treasurer. H. B. Beckett of a prominent firm of Portland attorneys is attorney for the committee. The committee has established headquarters in the Board of Trade building, Portland.

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SEC Approves Fee Action in Bond Case

Settling a three-year controversy over the payment of underwriting fees, the Securities and Exchange Commission has approved a proposal by Morgan Stanley & Co. to reduce its underwriting fees in the Consumers Power Co. bond sale from $50,802 to $16,160. Such compensation, according to the investment firm, would not exceed the compensation payable to an underwriter whose participation was not in excess of 5 percent of the offering.

The offer of Morgan Stanley & Co. to reduce the fees exempted the transaction from provisions of a commission rule (U-12F-2) that no underwriters' fees be paid to any person found to be an affiliate of the issuer. The commission also waived proceedings to determine whether Morgan Stanley is an affiliate of Consumers Power Co.

Utility Reports

	Net Income 1942	1941
*Alabama Power and subs...	$4,141,077	$3,536,462
†California Oregon Power...	1,258,395	898,414
*Cons. Gas Elec. Light & Power (Balto.) and sub....	6,178,285	6,701,383
*Ohio Edison	3,161,051	3,898,442
†Oklahoma Gas & Electric..	2,347,380	2,579,157
†Pennsylvania Power	639,811	777,537
†San Diego Gas & Electric..	1,548,382	1,545,447
*Sierra Pacific Power.....	562,601	714,479
†Southern Colorado Power...	303,636	263,929

* Twelve months ended December 31.
† Twelve months ended November 30.

FINANCIAL BRIEFS

THE SEC HAS APPROVED application of International Utilities Corp. to pay out of capital surplus a regular quarterly dividend February 1 on its $3.50 prior preferred stock at the rate of 87½ cents a share on the 97,370 shares presently outstanding. In another transaction the commission approved a proposal by the company to sell 76,235 shares of the common stock of its subsidiary, Securities Corporation General, to Cecil P. Stewart, a director of the Virginia company, for $125,787.

NATHAN A. SMYTH, trustee of the Washington Gas & Electric Co., announced recently that funds have been made available for the payment of the balance due on all first mortgage gold bonds of the company, including interest to February 1. The notice did not apply to the company's 6 percent first lien and general mortgage bonds, however. In December, 1941, a distribution amounting to 80 percent of the principal amount of the bonds was made.

MEMPHIS LIGHT GAS & WATER DIVISION earned a net profit of $2,853,866 for the fiscal year ended November 30, 1942, an increase of $532,451 over the preceding 12-month period. The electric department's net was $983,667. Revenues for the whole division for the period were $12,722,651, an increase over the former period of $1,273,235.

THE SEC HAS APPROVED an amendment filed by the Ogden Corp. requesting authority to sell to an insurance company $176,000 principal amount of Laclede Gas Light Co. refunding and extension mortgage bonds, 5 percent, at 99 plus accrued interest from October 1, 1942.

THE SEC HAS PERMITTED Northern States Power Co. (Del.) to postpone until June 30, 1943, payments on a $7,530,852 indebtedness to Northern States Power Co. (Minn.). Postponement was requested because the Delaware company's dissolution plan, before the commission, provides for disposition of the indebtedness by surrender to Northern States of Minnesota of 481,111 shares of its own common stock owned by the Delaware company.

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Simple Control Saves New Line Investment

By R. M. RYAN
Application Engineer
General Electric Company, Chicago

Recurring complaints of annoying ight flicker in one of the newer resi- ential areas of a midwestern city ere made to the local power com- any.

Investigation revealed the difficulty be due entirely to voltage variation n the distribution lines resulting rom the current pulsations of two ompressor motors installed in a local ce company's plant. The current ulsation was caused by the periodic oad variation of the two-cylinder, ertical, single-acting 180-r.p.m. com- ressors to which the synchronous otors were directly coupled. Maxi- um current pulsation occurred hen the compressors were synchro- ized at exactly identical crank an- les.

Tests showed the current pulsation f the motors to be well below the onventional limits of current ex- hange. Since these motors were al- eady equipped with ballast rings, ttle more could be accomplished in he way of additional flywheel effect o lower the current variation. Addi- onal weight on the rotors likely ould prevent the motors from start- g.

The light flicker could be com- letely eliminated by use of a sepa- ate 4,000-volt feeder from the exist- g substation, or by a new primary ne at 13,200 volts supplying a new ubstation. Either of these expedi- nts would have required an expendi- re of well over $10,000.

Further consideration of the prob- lem indicated that the compressors could be so operated that when one motor was experiencing maximum current input the other motor would be experiencing a minimum current input. This condition could be ac- complished if the motors could be synchronized so the two compressor cranks would be 90 mechanical de- grees apart. In consequence the flicker would be reduced in magni- tude and raised in frequency to the point where it no longer would be perceptible.

Verify Angle Between Rotors

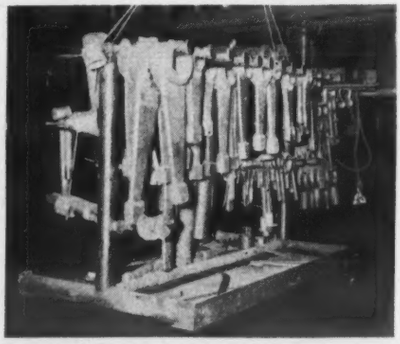
Tests were made to verify the con- clusions. White marks were painted on the motor rotors. Photo-flash pic- tures were made of the two rotors in motion to determine the angle between the two machines; the corresponding light flicker was observed. The posi- tion of the rotors indicated by the position of the white marks was varied by slipping the poles of one of the motors.

A simple control was then devised to synchronize the machines at the desirable angle; *i.e.*, with the cranks 90 deg. apart. A differential selsyn motor with a contact device was ener- gized by two selsyn generators, one directly connected to each compres- sor. By use of interlocking relays the control was made operative only when two machines were operating. It was made selective so that no mat- ter which compressor was operating the incoming machine would be auto- matically synchronized at the proper angle.

The method of starting was not altered and the operators were not affected by the change. At the re- quest of the ice company, a by-pass switch was installed at each motor starter to revert to the original method of operation in case of the failure of any of the synchronizing equipment. From reports to date these by-pass switches have never been used.

The installed cost of the control equipment was about $700. Light flicker complaints from this source have disappeared completely.

Turbine Tool Rack



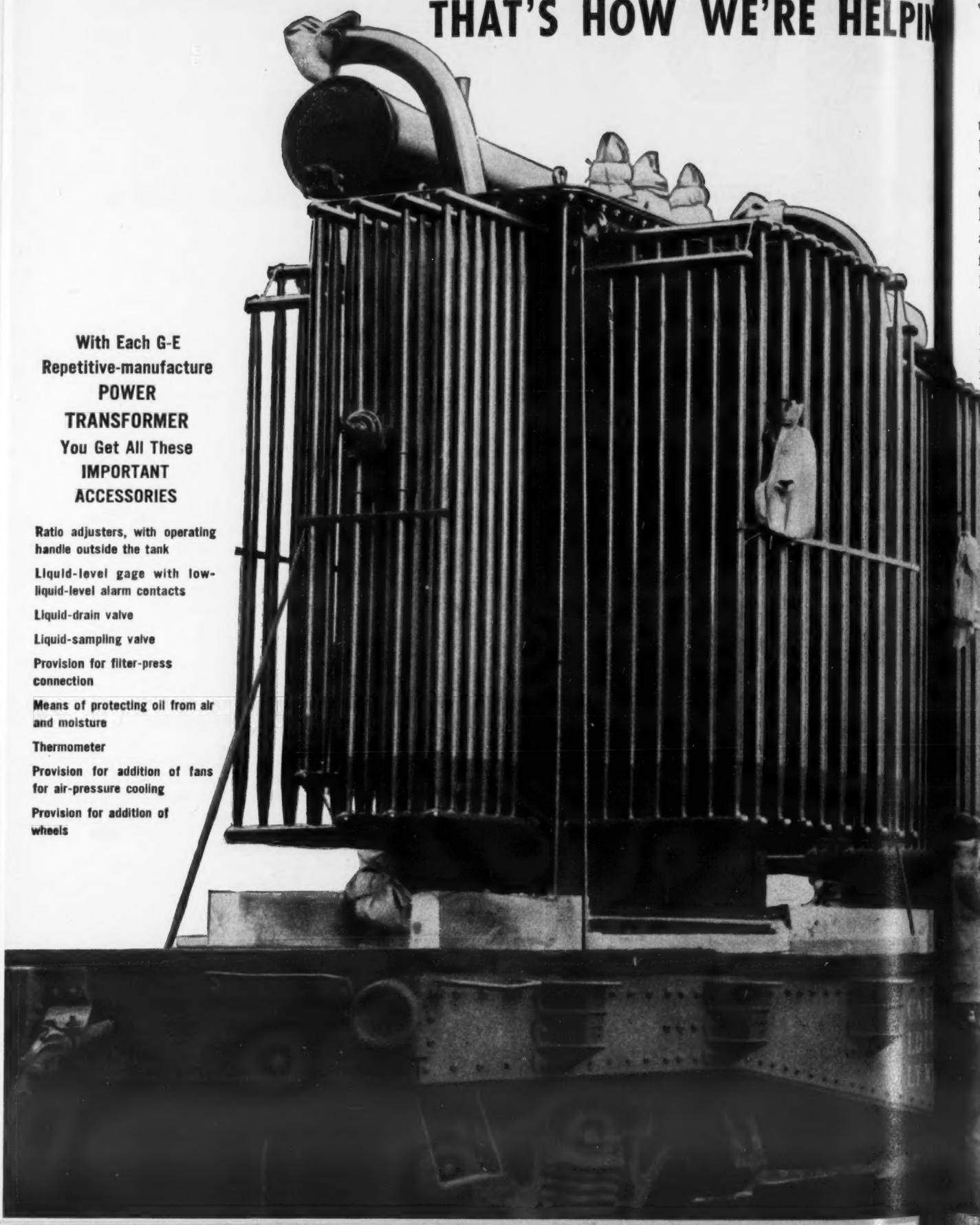
On this pipe rack are kept all of the wrenches and tools of various types used in the maintenance of steam turbines at the Fourth Street generating station of the Nebraska Power Company, Omaha. The rack is kept in an out-of-the-way place on the turbine floor until needed and then transferred by the crane to the working location.

WE BUILD A LOT OF T

THAT'S HOW WE'RE HELPIN

With Each G-E Repetitive-manufacture POWER TRANSFORMER You Get All These IMPORTANT ACCESSORIES

- Ratio adjusters, with operating handle outside the tank
- Liquid-level gage with low-liquid-level alarm contacts
- Liquid-drain valve
- Liquid-sampling valve
- Provision for filter-press connection
- Means of protecting oil from air and moisture
- Thermometer
- Provision for addition of fans for air-pressure cooling
- Provision for addition of wheels



THEM ALIKE . . .

YOU KEEP DOWN CAPITAL INVESTMENT

ONE way to get more goods for more people at less cost—and it's just as true of transformers as of lamps—is to build a lot of them alike. That is just what we have initiated and are doing in the field of large transformers. The savings in man-hours and materials are immediate. They are being passed on to the purchaser in the form of lower prices, or—if you will—a lower capital investment.

General Electric now offers, in a wide range of ratings, *repetitive-manufacture* power transformers that not only suit the majority of applications, but also effect appreciable savings in the purchase price as compared with transformers only slightly special.

G-E repetitive-manufacture power transformers are available in various ratings up to 5000 kva single-phase, and 7500 kva three-phase, with the normally used combinations of low-voltage and high-voltage ratings, as high as 69,000 volts. They are equipped with voltage taps and accessories in accordance with accepted practice as shown on the opposite page. *General Electric, Schenectady, N. Y.*

401-10

GENERAL ELECTRIC

Coal Handling Cost Cut in Two

By a radical change in the methods of shipping, handling and storing of coal at its Dubuque, Iowa, plant Interstate Power Company has cut the cost of handling coal exactly in two.

Formerly coal was brought into the plant storage yard principally by rail. Excess over the day-to-day plant coal requirements was distributed about the yard on a fanning system of tracks and piled with a railway crane. Segregation resulted from the piling operation and coal fires were frequent and severe.

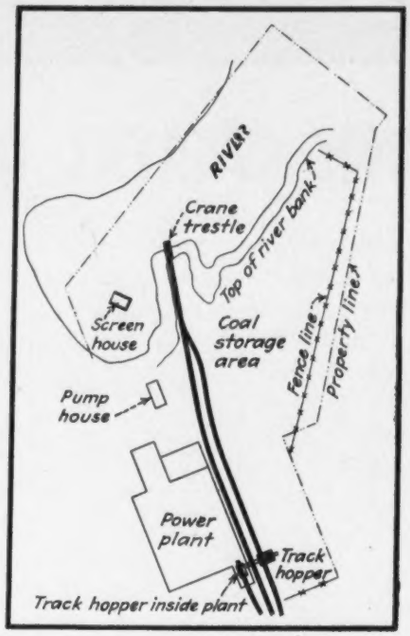
Although it was planned to have coal cars arrive six or seven a day and discharge directly into a track hopper within the plant, this seldom happened. Coal cars arrived in groups of as many as 40. They had to be unloaded in the yard and the coal piled by the crane until needed and then transferred to the plant. This resulted in excessive handling of the coal and increased cost.

Now about 70 percent of the coal used is shipped to the plant by barge. The rest comes by rail. The tracks in the storage yard have been abandoned and two 80-hp. tractors and a front-dumping scraper of 11 yd. capacity have been purchased to handle the coal.

The railway crane is still used to unload barges tied up at a trestle on the river bank, but it does not move about the yard, as was formerly necessary. The tractor and scraper distribute the coal throughout the storage yard, hauling an average of 75–80 tons of coal an hour and a maximum of 100 tons. Layer distribution and packing of the coal resulting from tractor and scraper operation has completely eliminated fires in the pile. Temperature readings now show that the coal has a lower temperature than the surrounding air.

Some coal is still brought into the plant by rail. This is dumped into the track hopper in the yard (see drawing), which delivers it by conveyor either to the bunkers or to a yard pile for distribution by the tractor and scraper. When necessary coal from yard storage is delivered by scraper to the track hopper in the yard and thence to the bunkers in the plant. Generally, however, the scraper supplies the plant at the same time that it distributes coal in the yard.

These changes in the methods of coal handling at the Dubuque plant are credited with reducing the cost of coal handling from about 12 cents to 6 cents per ton of coal and also with reducing coal losses from fires to substantially zero.



LAYOUT of coal storage area at Dubuque plant

TRACTOR and front-dumping scraper replace crane and tracks for handling coal in storage yard; change has cut handling costs and solved segregation problem

Cold Cathode Tubes Used on Relays—I

By E. C. SCHURCH
Senior Electrical Engineer, Electrical Design Section, Bureau of Reclamation, Denver, Colo.

A cold cathode gas-filled tube used as the fault-detecting agent of protective relays offers an advantage in speed of operation, low burden and freedom from false operation due to mechanical vibration and shock. This type of tube is suited to such an application since it has no filament to keep continuously energized and is therefore completely dormant except when the fault current rises above the pick-up point.

Rated life of the tube is approximately 300 hours when continuously energized at its full rated load, but this rating seems to be very conservative. The intermittent loads of short duration as obtained in protective-relay applications will give many thousands of relay operations without requiring tube replacement.

The grid voltage required to initiate conduction is quite definite and is unaffected by large variations in the anode voltage, which results in accurate pick-up, even under conditions of varying station-battery voltage. When direct current is used on the anode, the anode current will continue to flow after being started by a grid discharge and must be stopped by opening the anode circuit by means of a reset push button or breaker "a" switch, thus forming an electrically sealed-in relay circuit.

Two tubes are used for single-phase relays in order to provide a spare tube in case one should fail. The relays are capable of energizing the

iliary relay coil in a time of less n one-sixtieth of a second to sev- l seconds, depending on the magni- e of fault current and setting of relay. The time-current character- cs are similar to those obtained h the conventional induction-type ays except that a much shorter imum time is obtainable. If in- ntaneous operation only is desired, condenser C_1, resistor R_3 and the tifier (indicated in subsequent dia- ms) are omitted, and the relay l operate in a small fraction of a f cycle. The sensitive fault-detect- features of the relays have no ving parts and are therefore not ject to false operations due to me- nical vibration and shock.

The burden of the relays on the trument transformers is very small. ergy required at the tube grid cir- t to initiate conduction is about milliampere at 75 volts, or 0.0075 t-ampere, while the resulting en- gy in the anode circuit is as much 0.1 amp. at 125 or 250 volts. In- ding the losses in the transformer d resistors, the total burden on the trument transformers is approxi- tely 0.5 volt-ampere at 5 amp. for overcurrent-type relay. Since the nsformer saturates near the mini- m pick-up point of the relay, the rden at 10 times normal current is ly about 15 volt-amperes. The bur- n can probably be reduced further h improved design.

A description of an overcurrent-type relay, a differential-type relay, and a directional ground relay will be given in subsequent articles in this series.

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Properties of Pyrex Multiform Glassware

Properties of Pyrex brand Multiform Ware are determined by the basic glass compositions used in their manufacture.

Glass No. 790 combines the properties of very low thermal expansion, resistance to high temperatures, great chemical durability and very low dielectric losses. This glass meets all the requirements of the U. S. Navy standard RE-13A-317F, Grade G. It is suitable for a wide variety of applications in the electrical industry. Glasses Nos. 7761 and 707 also have very low dielectric losses and can be used as insulation at extreme frequencies. Laboratory tests show that all Pyrex brand Multiform glasses in the table will meet the proposed A.S.A. American War Standard on Radio Insulating Materials of Low Dielectric Constant, Grades L-5 and L-6. The properties of No. 774 glass, as made by conventional processes, are included in the accompanying table for comparative purposes. This glass has been successfully used for many years for power and radio insulators, fuse tubing and bushings, lightning arresters and for other electrical purposes. Properties of the commercial steatites and electrical porcelains are also included in the table.

Mechanical and Dielectric Strengths

Mechanical strength of glass as a material depends upon shape and size of the article, type and duration of loading, and procedure used in testing, as is the case with all ceramic materials. Furthermore, for any one group of samples, similarly tested, there will be considerable variation between the strength of individual specimens. Under comparable conditions, glass products made by the Multiform process are somewhat less strong than products of the same composition fabricated conventionally. The results of a series of bending tests made on bars, 0.68 in. wide and 0.25 in. thick, prepared by the Multiform process, both annealed and tempered, are given in the table.

Dielectric strengths of Pyrex brand Multiform products are lower than those products of the same composition conventionally formed, but are adequate for all ordinary applications and generally are much higher than for other ceramic products.

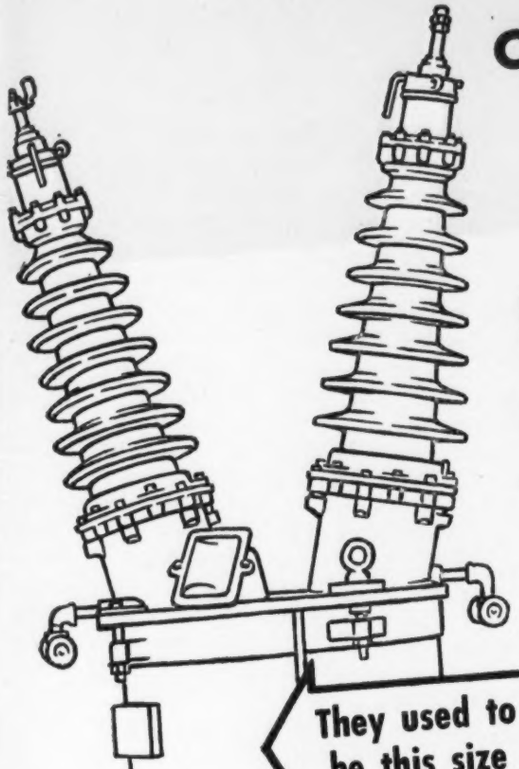
mparative Properties of Glasses made by Conventional and Multiform Processes, and of Other Well-Known Ceramic Materials

s code		790		7761		707		774		
s type									Steatites*	Electrical *Porcelains
ineering Properties	Unit	Conventional	Multiform	Conventional	Multiform	Conventional	Multiform	Conventional		
sity	.....	2.18	2.15	2.16	....	2.13	2.10	2.23	2.5–2.8	2.3–2.5
ening temperature	Deg. C.	1500	....	....	....	745	....	820	1250–1400	1500–1600
. operating temp.	Deg. C.	900	800	500	500	425	425	500	.....	.....
ar expansion (0–300 deg. C.)	per deg. C.x 10^{-7}	7.8	8.5	28	....	31	32	32	60–90	30–50
er absorption — 24 hrs.	%	None	<.01	None	<.01	None	<.01	None	0–0.1	0–2.0
dulus of rupture — annealed glass	lbs./in.^{2} x 10^3	....	5	10	7	10	7	10	.....	6–12
dulus of rupture — tempered	lbs./in.^{2} x 10^3	....	....	18	....	18	12	18	17–24	....
ume resistivity										
log R at 20 deg. C.	ohms	13.5	....	....	....	17.0	....	14.7	14	12–14
log R at 250 deg. C.	per	9.7	9.3	12.3	....	12.1	....	8.1	9–14	7–10
log R at 350 deg. C.	cm. cube	8.1	7.8	10.2	....	10.1	....	6.7	8–13	6– 8
ectric strength	volts/mil	high	>500	high	>500	high	>500	high	200–300	200–280
C.—20 deg. C.— 60 cycles	.....	4.5	....	....	....	3.95	....	4.80	.....	....
1 KC	.....	....	....	....	....	3.95	....	4.70	.....	....
1 MC	.....	4.0	4.0	4.0	4.0	3.95	4.0	4.65	5.5–7.5	5.0–7.5
— 20 deg. C. — 60 cycles	%	0.065	....	....	....	0.06	....	1.27	.....	....
1 KC	%	....	....	....	....	0.06	....	0.77	.....	....
1 MC	%	<0.05	0.18	0.09	0.11	0.06	0.10	0.42	0.03–0.20	0.70–1.2
— 20 deg. C. — 60 cycles	%	0.29	....	....	....	0.24	....	6.08	.....	....
1 KC	%	....	....	....	....	0.24	....	3.62	.....	....
1 MC	%	<0.20	0.72	0.36	0.44	0.24	0.40	1.95	0.15–1.24	3.5–9.0

* Data from Rigterink, M.D., Review of Scientific Instruments, Vol. 12, No. 11, 527–534 (1941).

For the First Time

A COMPLETE LINE OF SMALL-SIZE OUTDOOR INSTRUMENT TRANSFORMERS



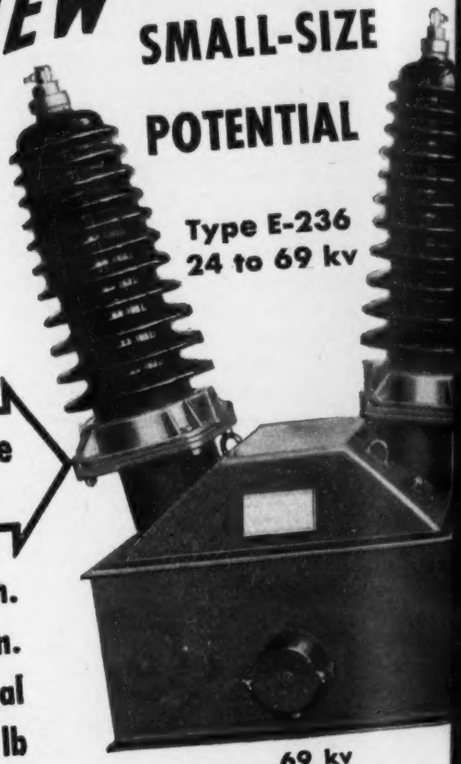
They used to be this size

Type E-116
69 kv

HERE ARE YOUR *NEW* SMALL-SIZE TWO-BUSHING TRANSFORMERS

POTENTIAL

Type E-236
24 to 69 kv



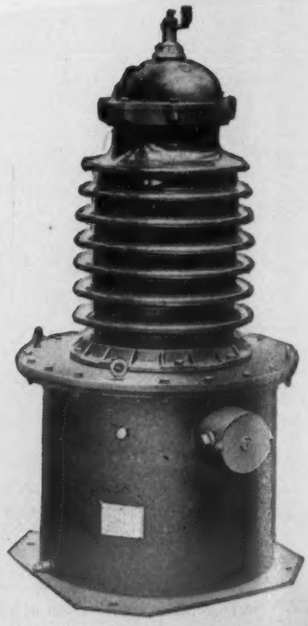
Now they're this size

69 kv

108 in.	Height	55 1/2 in.
26 1/4 in.	Width of base	28 1/2 in.
125 gal	Liquid volume	20 gal
2400 lb	Net weight	1000 lb

AND HERE ARE THE COMPANION SMALL-SIZE G-E TRANSFORMERS THAT WERE ALREADY AVAILABLE

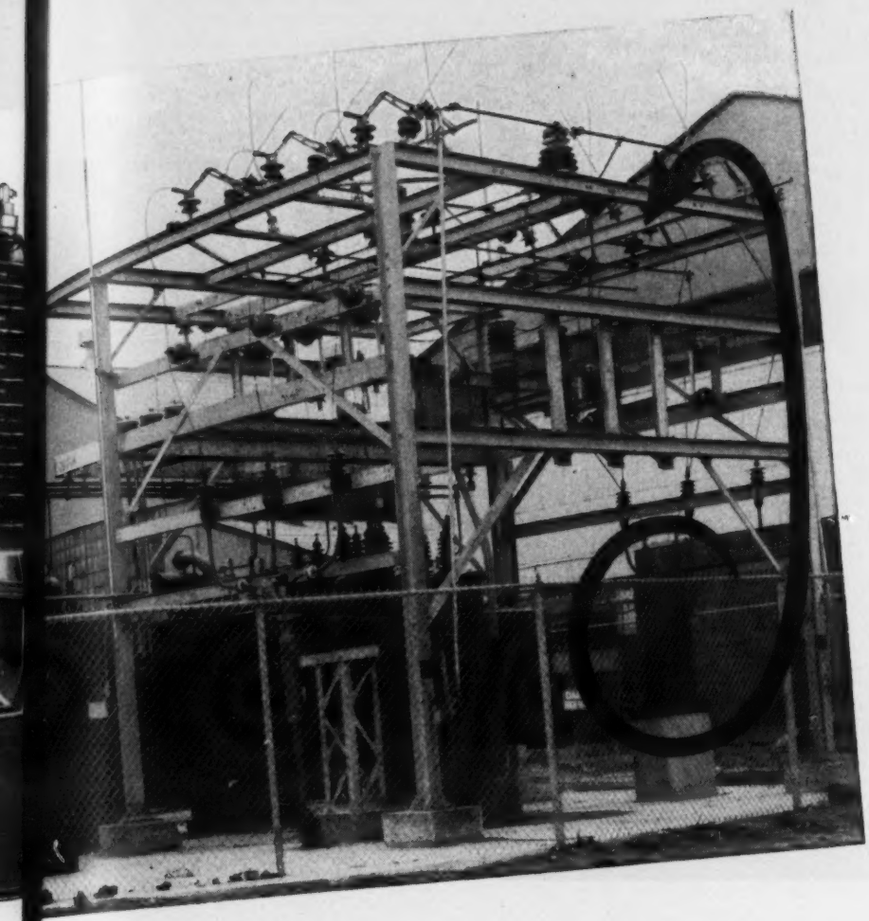
Current transformers



Single-bushing potential transformers

Now You Can Mount Them All up in the Structure

and get these advantages



SAVE SPACE

The small size and light weight of these G-E transformers make it possible to mount them up in the structure and save valuable ground space.

SIMPLIFY CONNECTIONS

Mounting in the structure simplifies primary (high-voltage) connections.

New structures can be designed to take full advantage of the small size and light weight of these units, and transformers can be installed in existent structures without building a separate foundation. You don't need to consider the testing or inspecting of the insulating liquid, because it is sealed in—thus reducing maintenance.

CHARACTERISTICS

Both accuracy and insulation characteristics have been maintained in spite of the reduction in size and weight.

ACCURACY—These transformers meet the highest accuracy classification, and are suitable for either metering or relaying.

Current transformers	¼X, ¼Y, ¼ Z
Single-bushing potential transformers	¼W, ¼X, ¼Y, ¼Z
Two-bushing potential transformers	¼W, ¼X, ¼Y, ¼Z

INSULATION—Ample insulation is provided to meet the ASA standards on both impulse and low-frequency tests.

FOR THE "LAST OUNCE" OF PROTECTION SPECIFY PYRANOL*

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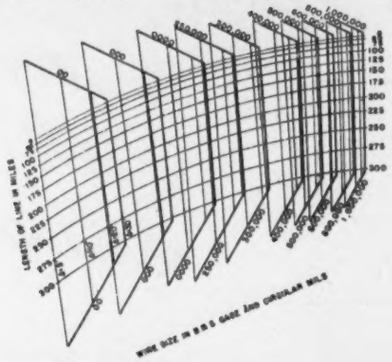
GENERAL ELECTRIC

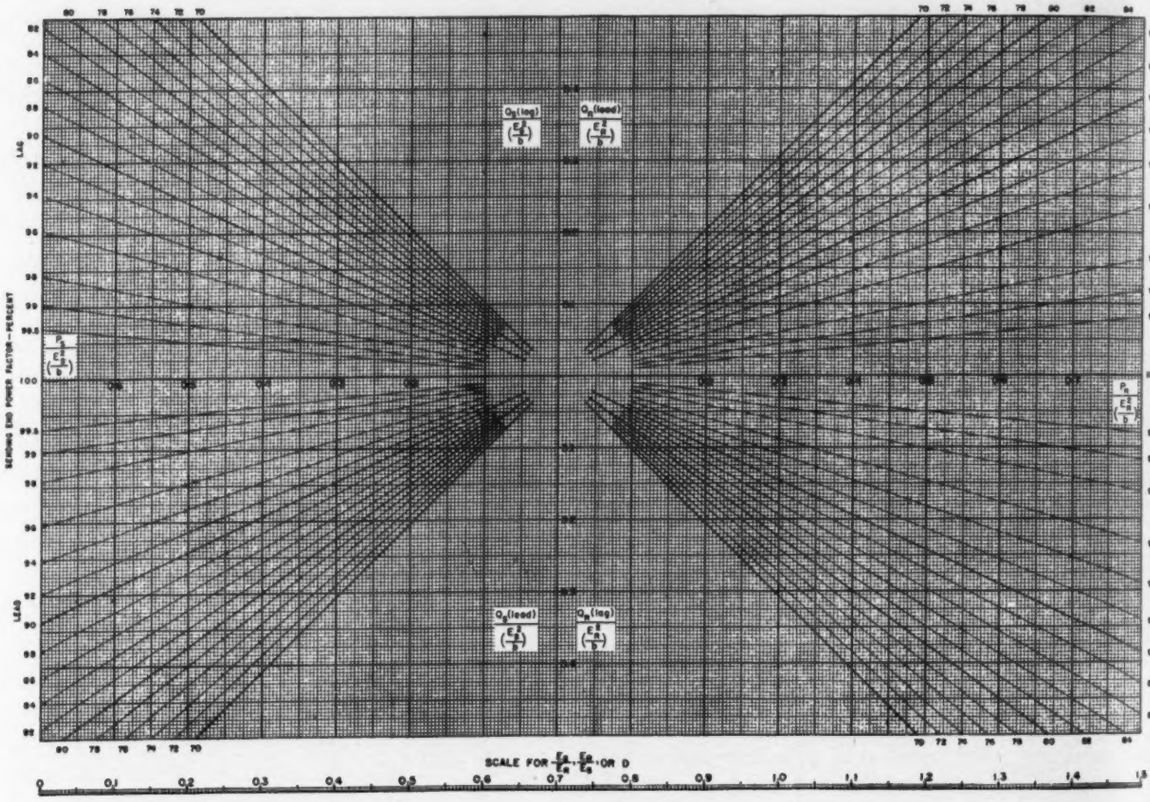
604-10-6400

60-CYCLE UNIVERSAL TRANSMISSION LINE CHART



To determine (1) voltage regulation, (2) efficiency, (3) angle between sending- and receiving-end voltages, (4) minimum size of synchronous condensers or static condensers (capacitors) or reactors required, (5) maximum amount of power which may be transmitted, (6) no-load voltage regulation at end of the line, no-load charging kva. Typical examples are given on opposite and in subsequent data pages.

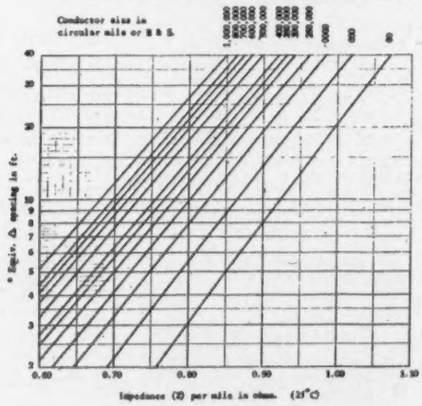
P is total megawatts for 3-phase circuits, or twice the megawatts for 1-phase circuits; Q is total megavars for 3-phase circuits, or twice the megavars for 1-phase circuits; E is line-to-line kilovolts; R and S are respective receiving- and sending-end subscripts; $b = l'_s \times Z$.



**CORRECTED LENGTH OF LINE (L') FOR 60-CYCLE IMPEDANCE

Actual Length (Miles)	Value of L'									
	0	1	2	3	4	5	6	7	8	9
0	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
10	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0
20	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0
30	30.0	31.0	32.0	33.0	34.0	35.0	36.0	37.0	38.0	39.0
40	40.0	41.0	42.0	43.0	44.0	45.0	46.0	47.0	48.0	49.0
50	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0
60	60.0	61.0	62.0	63.0	64.0	65.0	66.0	67.0	68.0	69.0
70	70.0	71.0	72.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0
80	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0
90	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0	99.0
100	99.9	100.9	101.9	102.9	103.9	104.9	105.9	106.9	107.9	108.9
110	109.9	110.9	111.9	112.9	113.9	114.9	115.9	116.9	117.9	118.9
120	119.8	120.8	121.8	122.8	123.8	124.8	125.8	126.8	127.8	128.8
130	129.8	130.8	131.8	132.8	133.8	134.8	135.8	136.8	137.8	138.8
140	139.8	140.8	141.8	142.8	143.8	144.8	145.8	146.8	147.8	148.7
150	149.7	150.7	151.7	152.7	153.7	154.7	155.7	156.7	157.7	158.7
160	159.7	160.7	161.7	162.7	163.7	164.7	165.7	166.7	167.7	168.7
170	169.6	170.6	171.6	172.6	173.6	174.6	175.6	176.6	177.6	178.6
180	179.6	180.6	181.6	182.6	183.6	184.6	185.6	186.6	187.6	188.6
190	189.6	190.6	191.6	192.6	193.6	194.6	195.6	196.6	197.6	198.6
200	199.5	200.5	201.5	202.5	203.5	204.5	205.5	206.5	207.5	208.5
210	209.5	210.5	211.5	212.5	213.5	214.5	215.5	216.5	217.5	218.5
220	219.5	220.5	221.5	222.5	223.5	224.5	225.5	226.5	227.5	228.5
230	229.5	230.5	231.5	232.5	233.5	234.5	235.5	236.5	237.5	238.5
240	239.5	240.5	241.5	242.5	243.5	244.5	245.5	246.5	247.5	248.5
250	249.5	250.5	251.5	252.5	253.5	254.5	255.5	256.5	257.5	258.5
260	259.5	260.5	261.5	262.5	263.5	264.5	265.5	266.5	267.5	268.5
270	269.4	270.4	271.4	272.4	273.4	274.4	275.4	276.4	277.4	278.4
280	279.4	280.4	281.4	282.4	283.4	284.4	285.4	286.4	287.4	288.4
290	289.4	290.4	291.4	292.4	293.4	294.4	295.4	296.4	297.4	298.4
300	299.3	300.3	301.3	302.3	303.3	304.3	305.3	306.3	307.3	308.3
310	309.3	310.3	311.3	312.3	313.3	314.3	315.3	316.3	317.3	318.3
320	319.3	320.3	321.3	322.3	323.3	324.3	325.3	326.3	327.3	328.3
330	329.3	330.3	331.3	332.3	333.3	334.3	335.3	336.3	337.3	338.3
340	339.2	340.2	341.2	342.2	343.2	344.2	345.2	346.2	347.2	348.2
350	349.2	350.2	351.2	352.2	353.2	354.2	355.2	356.2	357.2	358.2
360	359.2	360.2	361.2	362.2	363.2	364.2	365.2	366.2	367.2	368.2
370	369.2	370.2	371.2	372.2	373.2	374.2	375.2	376.2	377.2	378.2
380	379.2	380.2	381.2	382.2	383.2	384.2	385.2	386.2	387.2	388.2
390	389.2	390.2	391.2	392.2	393.2	394.2	395.2	396.2	397.2	398.2
400	399.2	400.2	401.2	402.2	403.2	404.2	405.2	406.2	407.2	408.2
410	409.2	410.2	411.2	412.2	413.2	414.2	415.2	416.2	417.2	418.2
420	419.2	420.2	421.2	422.2	423.2	424.2	425.2	426.2	427.2	428.2
430	429.2	430.2	431.2	432.2	433.2	434.2	435.2	436.2	437.2	438.2
440	439.2	440.2	441.2	442.2	443.2	444.2	445.2	446.2	447.2	448.2
450	449.2	450.2	451.2	452.2	453.2	454.2	455.2	456.2	457.2	458.2
460	459.2	460.2	461.2	462.2	463.2	464.2	465.2	466.2	467.2	468.2
470	469.2	470.2	471.2	472.2	473.2	474.2	475.2	476.2	477.2	478.2
480	479.2	480.2	481.2	482.2	483.2	484.2	485.2	486.2	487.2	488.2
490	489.2	490.2	491.2	492.2	493.2	494.2	495.2	496.2	497.2	498.2
500	499.2	500.2	501.2	502.2	503.2	504.2	505.2	506.2	507.2	508.2

**60-CYCLE IMPEDANCE (Z) OF HARD DRAWN COPPER CONDUCTORS



LENGTH OF REFERENCE LINE (D) FOR MEASURING ANGLE BETWEEN SENDING- AND RECEIVING-END VOLTAGES

ACTUAL LENGTH (MILES)	VALUES OF D
0 - 130	1.000
130 - 185	1.001
185 - 215	1.002
215 - 235	1.003
235 - 250	1.004
250 - 265	1.005
265 - 290	1.006
290 - 295	1.007
295 - 310	1.008

* The equivalent delta spacing of any three-phase arrangement of conductors is $\Delta = \sqrt[3]{AB \times BC \times AC}$. For single-phase Δ equals distance between phase conductors.

FEDERAL POWER COMMISSION,
BUREAU OF WATER POWER
MARCH 1942

**From "Performance Charts for 60-Cycle Transmission Lines up to 300 miles in length," by C. C. Whitehead, Edith Clarke, and R. H. Stinger, pages 510 and 525, General Electric Review, October, 1932.

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OR H.-D. STRANDED COPPER CONDUCTORS

GUIDE FOR USE OF CHART

By J. M. SHEPLEY and C. B. WALTON
Bureau of Water Power, Federal Power Commission, Washington, D. C.

Analysis of a 60-cycle transmission line of hard-drawn stranded copper conductor can be made by use of a chart based on the so-called exact transmission line theory. This type of chart (see opposite page) has the general form of the well-known circle diagram. Basic scales have been chosen so that an infinite number of circle diagrams may be placed on a single chart. A similar chart has been developed for aluminum cable steel reinforced (ACSR).

Use of the "copper" chart is illustrated by typical examples; one is given below and two others will be given in a subsequent issue. In illustrations CP = center point, OPR = operating point for receiving end and θ = angle between sending- and receiving-end voltages.

EXAMPLE

A 200-mile, 60-cycle, single circuit three-phase line has three 500,000 cir.mil hard-drawn stranded copper conductors with an equivalent delta spacing of 30 ft.

For a receiving-end voltage of 220 kv. find the sending-end voltage angle between receiving- and sending-end voltages, efficiency of transmission for a received load of 60 megawatts at 0.90 power factor.

Referring to tables under the chart, length of the reference line D for measuring angle between sending and receiving-end voltages for the 200-mile line is 1.002 to the scale shown on the chart.

Corrected length of line l', for an actual length of 200 miles is 194.5 miles.

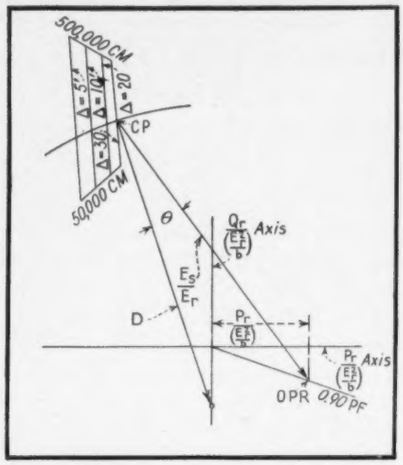


FIG. 1—Solving for voltage regulation and angle between sending- and receiving-end voltages

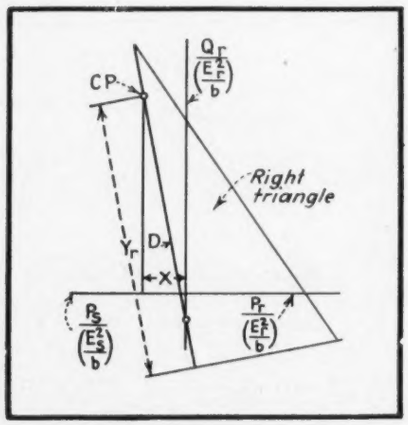


FIG. 2—Determining efficiency

Impedance (Z) corresponding to an equivalent delta spacing of 30 ft., and for 500,000-cir.mil wire, is 0.862 ohm per mile.

$$\text{Now } b = l' \times Z = 194.5 \times 0.862 = 167.7$$

$$\text{and } \frac{P_r}{2} \div \frac{E_r}{b} = \frac{60}{(220)^2} \div \frac{}{167.7} = 0.2079$$

Consider that the scale of the chart corresponds to 10 centimeters equals unity. Next measure the distance between the center point (CP) (see Fig. 1) in the upper left-hand part of the same chart, as fixed by the length, size and spacing, and a receiving-end operating point (OPR) determined by the computed value of $P_r/(E^2_r/b)$ and the power factor line corresponding to 0.90 lag. This distance scales 10.63 centimeters, and hence the value of E_s/E_r equals 1.063, and therefore $E_s = 1.063 \times 220 =$ 233.9 kv.

By referring to Fig 1 the angle (θ) between the sending- and receiving-end voltages is found as follows: From the center point lay off a distance $D = 1.002$, or 10.02 centimeters, to the $Q/(E^2_r/b)$ axis. The angle between the D line and the E_s/E_r line is the desired angle. For our example this angle is about 11.1 degrees.

To determine the efficiency we will first determine the transmission loss. Referring to Fig. 2 take an ordinary right-angled triangle. Lay one side along the D line as shown and slide the triangle along this line until the adjacent side passes through the operating point, then measure the distance Y_r as shown. Next drop a line from the center point perpendicular to the $P_s/(E^2_s)/b$ axis is then found from the following equation:

$$L = \frac{E_r^2}{b}(X)\left[1 + \left(\frac{E_s}{E_r}\right)^2 \frac{2Y_r}{D}\right] \quad \text{or}$$

$$L = \frac{\overline{220^2} \times 0.133}{167.7}\left[1 + 1.063^2 - \frac{2 \times 1.044}{1.002}\right]$$

$$= 1.77 \text{ Mw.}$$

$$\text{Efficiency} = \frac{60}{60 + 1.77} \times 100 = 97.1\%$$

Transformer Fusing*

5. Emergency Substitutes for Fuse Holders

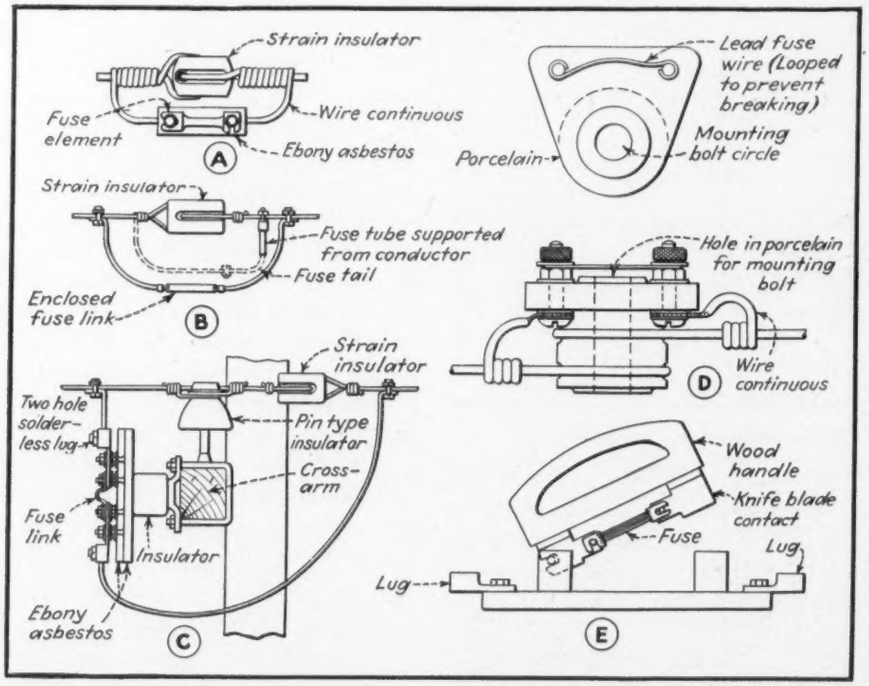
By H. L. LOWE

Ebasco Services, Inc., New York

Secondary fuses and fuse holders, required for protection of distribution transformers against overload when "oversized" primary fuses are employed, can be made locally if necessary. The fuses can be cut or stamped out of thin copper sheets and the fuse holders, which require a relatively low insulation strength, can be assembled from insulators and conductor parts salvaged from the average scrap pile. Special designs, of course, may be required for particular areas, where atmospheric or other conditions are unusual.

Some secondary fuse holders have been made by mounting two binding posts on a strip of ebony asbestos or some other form of fairly good insulating material and merely suspending them in the secondary leads. The fuse element can be made of strands of No. 30 copper wire (used in most lamp cord) or some other suitable material, such as lead wire which will fuse at the desired value of current. Some suggestions for types of secondary fuse holders which can be made locally are shown in the accompanying sketches.

*This is the fifth of a series of articles which began in December 12, 1942, issue of "Electrical World."



VARIOUS TYPES of secondary fuses and fuse holders which may be made as emergency substitutes

In A continuous wire connection may be replaced by a bronze casting; in B, solid and dotted lines indicate alternate for A; in C a rigid mounting is provided for fuse holder; design D is a type built with salvaged materials; design E has a knife switch action, uses a "homemade" fuse link of 50-50 silver-copper, for capacities of 100 to 1,000 amp.

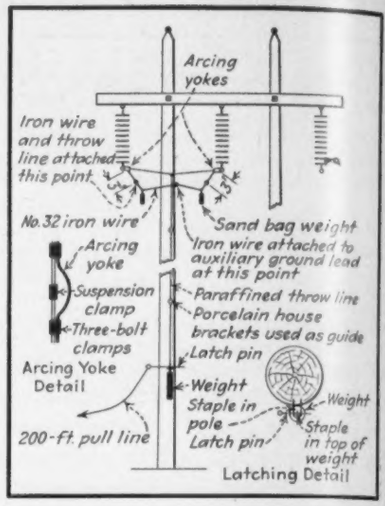
Grounding Scheme for Staged Fault Test

By ALLAN CHANTRY

Nebraska Power Company, Omaha, Neb.

Simultaneous and intentional application of ground faults to two phases of a transmission line is not easy to arrange. For the staged fault test on the recently completed Kansas-Nebraska 268.52-mile, 154-kv. transmission line, however, it was done effectively, as shown, by an ingenious gravity-actuated device.

These staged fault tests were made under load conditions to check the transient stability limits of this important line and the proper functioning of relays and breakers. The line interconnects the systems of the Nebraska Power Company and the Kansas Gas & Electric Company.



SCHEME applies grounds to two phases simultaneously in staged fault tests on 154-kv. line

For the success of the tests it was vital that the ground faults be applied to the two phases simultaneously. Also, because of the tendency of the arc to strike before ground contact was actually completed, it was necessary that the grounds be applied with a motion that started slowly and increased in velocity as it approached the phase wire. Third condition was that the material used to strike the arc should disappear instantly to simulate a lighting arc.

Preliminary experiments established that a No. 32 iron wire, of the type commonly used for attaching shipping tags, had enough strength (fuse wire did not) and in addition disintegrated rapidly under the arc. Acceleration of a freely falling body simulated the motion desired for applying the fault. It only remained to devise a method of combining these elements in a device that would ground the two phases simultaneously. This was done as described in the following:

Copper arcing yokes were made by bolting 8-ft. lengths of scrap cable to the two phase conductors to form a loop around the suspension clamp. For each phase to be grounded a length of the No. 32 iron ground wire, weighted with a sand-filled tobacco pouch, was fastened to a measured length of paraffined throw line. This line was passed through the arcing yoke and adjusted to give exactly 3 ft. clearance between the yoke and iron wire. The throw lines control-

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Why Rockbestos Permanent Insulation provides dependable wire performance

Rockbestos A.V.C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and this permanently insulated construction.

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly and permanently centred in helically applied insulation.

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WON'T bake brittle, bloom, burn or rot
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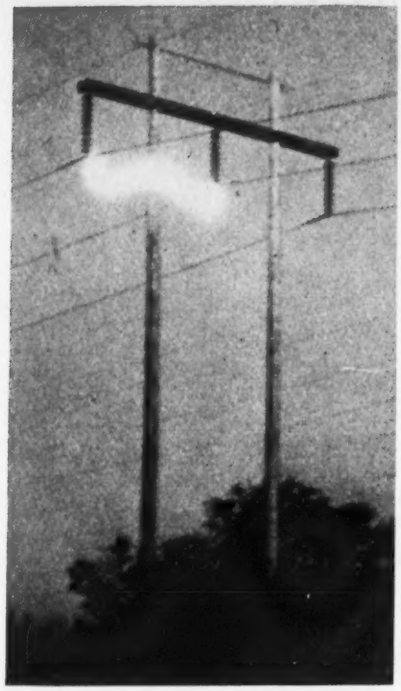

FAULT resulting from application of two-phase-to-ground faults on Kansas-Nebraska 154-kv. line

ling the iron wire for each of the two phases were tied at the same point to a single paraffined line that ran down the pole to a weight suspended near the base of the pole.

A latch pin held the weight in position until the time for the test. A 200-ft. rope was attached to this latch pin.

At the instant of the test this rope was pulled, the latch pin disengaged, the weight dropped, pulling the iron ground wires into contact with the two phase conductors simultaneously. Study of the oscillograms showed that the two grounds were applied within one cycle of each other. The arc flash that resulted lasted about one-tenth of a second. Only one-third of a second was required for opening and reclosing the switches and restoration of normal service.

To insure that the throw line, mentioned in the foregoing, was completely dry it was boiled in paraffin for several hours before being installed on the test structure.

•

Boiler Output Rise by Draft Changes

By JOHN CASSIE
Installation Analysis Department,
B. F. Sturtevant Co., Hyde Park, Mass.

In a group of steam-generating units which failed to deliver designed rating, extended field tests indicated that the induced-draft fan had more than ample capacity, while the forced-draft fan appeared to act as a bottleneck without sufficient capacity to match that of the induced-draft fan so as to maintain proper slight suction in the furnace. It was desired to raise the steam output in the quickest and simplest manner. In this "duplex" arrangement of fans, both forced- and induced-draft wheels are on a common shaft, and in this case driven by a common turbine. The capacity excess of the induced-draft fan relative to the forced-draft fan was of no practical use, since this excess had to be dampered out at *C* (Fig. 1) to maintain a furnace balance. The partial closing of this damper caused a pressure loss and waste of energy in producing it.

Two methods of solving the problem were considered. In the first it was suggested that a series of flat plates (details in ELECTRICAL WORLD, April 4, 1942, page 49) be placed in the induced-draft fan inlet *A-B* in such a manner as to spin the gases in the same direction as the wheel rotation. By trial, these plates were to be closed to a point where the forced- and induced-draft capacities were matched, the furnace draft being maintained slightly below boiler room atmospheric, and all while damper *C* was practically wide open. These flat plates would then be permanently fastened in this position. Final small variations in this draft balance would be secured by slight adjustments in the position of damper *C*. This set-up would eliminate practically all the pressure loss across damper *C*, saving considerable power when the "as installed" volumes are flowing. This saving in power, it was thought, could be utilized to speed up both the forced- and induced-draft fans to obtain higher rating.

Retain "As Installed" Speed

The foregoing method would have been very satisfactory and inexpensive had it not been found inadvisable to allow the rotating element to speed up as planned. The new operating speed would have been too close to the critical speed, and so the second method, resorting to a remedy at the "as installed" speed, became necessary. This meant, indirectly, a decrease in forced-draft system resistance.

The second method, which was adopted, is indicated in Fig. 2. By rotating the air preheater about point *D* of Fig. 1, through 90 deg. with translation to a new center *E*, of Fig. 2, a much more advantageous relation between forced-draft discharge and air inlet to the preheater was gained. The remaining 45-deg. turn was vaned as shown, the upstream ends of these vanes being adjustable by trial during operation, to the relation giving maximum capacity, and fixed thus,

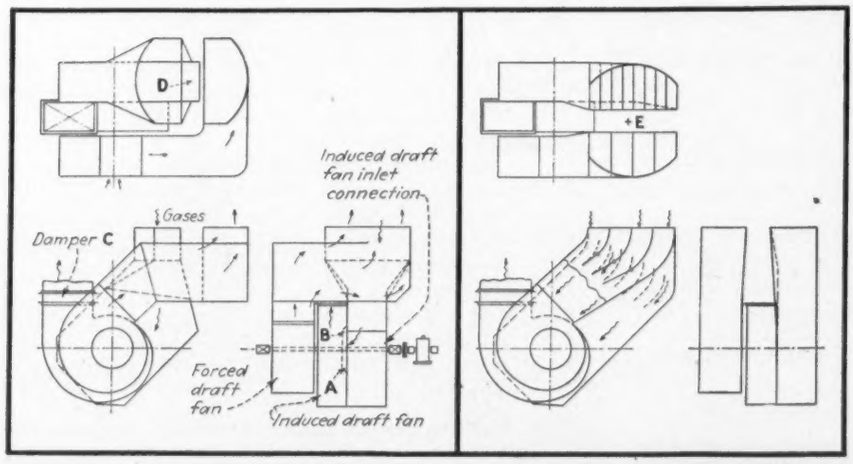

FIG. 1—Initial layout of forced and induced fans and ducts. Here the fans were not properly matched in performance to enable boiler rated output to be delivered

FIG. 2—Rotation of air preheater through 90 deg. and translation to a new center *E*, with elimination of two 90-deg. elbows and installation of vanes, did away with complaints of insufficient steam

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A. W. G. or M. C. M.	No. of Strands #34	O. D. Inches	Net Pounds per 100 ft.	Welding Current Capacity Amperes	Voltage Drop Max. Current Volts per 100 ft.
8	420	.39	10	50	3.71
6	686	.40	13	75	3.58
4	1078	.50	20	100	3.18
3	1372	.50	23	150	3.70
2	1715	.56	29	200	3.92
1	2156	.63	36	250	3.88
1/0	2695	.68	43	300	3.72
2/0	3381	.75	54	375	3.68
3/0	4263	.82	67	450	3.51
4/0	5341	.90	83	550	3.41
250	6321	.95	96	600	3.12
300	7595	1.03	115	650	2.80

All TIREX CABLES- for the duration - conform to government regulations controlling the use of copper and rubber. If you need cables to keep welding equipment going on war work you can avoid cable failures and replacements, save copper and the other critical materials and get the results you want with TIREX.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex
WIRES and CABLES

permanently. Two 90 deg. elbows were also eliminated.

This new location of the air preheater improves conditions for not only the forced-draft ducts and fan but greatly betters the relation between the induced-draft ducts and fan.

In the original installation the gases leaving the preheater received a "quarter twist," and in addition the change in flow direction caused a spin inside the inlet box. Both of these features reduced the capacity and efficiency of the fan. With the relation of the induced-draft fan and its ductwork as shown in Fig. 2, the only condition giving concern is the change of direction of gas flow. This is readily and almost wholly corrected by the corner turn sheets as indicated.

•

Control Series Lights From Several Points

While the usual series protective lighting system prefers control from one station, certain project circumstances may favor independent remote control of lighting from any one of several strategic locations, for convenience in air raids, blackouts or whatever. For such series lighting systems, the circuit shown provides remote control of the constant-current transformer primary from any one of several push-button stations at fence gates, guard towers, and the like. The circuit is a development of the South Bend Current Controller Company, South Bend, Ind.

The circuit as drawn shows the coil of the type AN oil switch energized and the series lighting circuit operating.

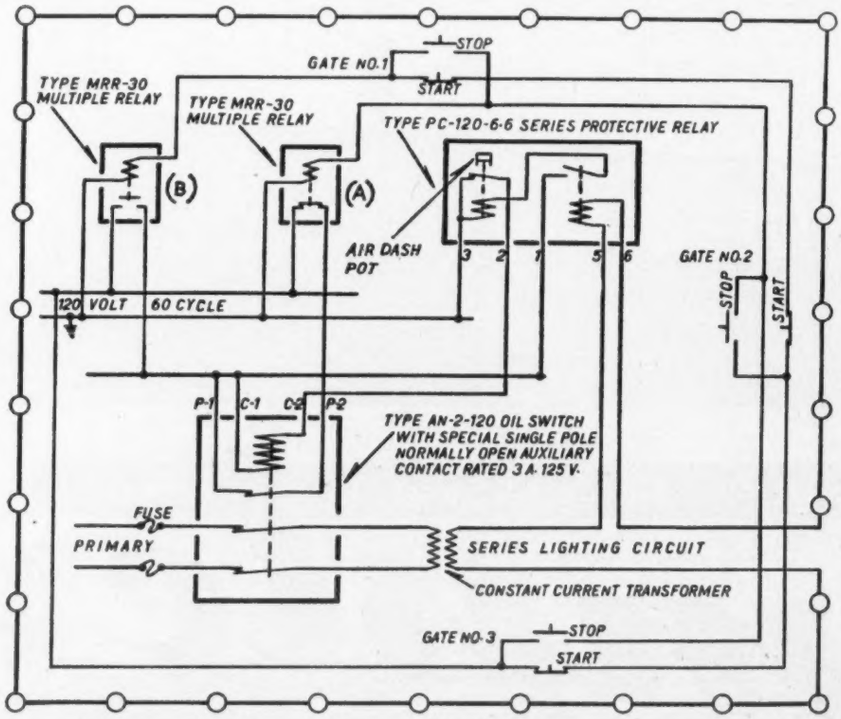
Momentary closing of any "stop" button will de-energize the circuit.

For the condition shown the coil of the oil switch is energized at 120 volts, 60 cycles through the contacts of one (A) of two MRR-30 multiple relays (A) and (B) and the special single-pole normally open auxiliary contacts added to the oil switch. Should any "stop" button be closed, the coil of the multiple relay (A), mentioned, will be energized, opening the contacts-oil switch, which will then open the primary circuit to the constant-current transformer.

However, should a fault develop which de-energizes the control circuit when the lights are "off," contacts of the second MRR-30 multiple relay (B) (which have been held open up to now) will drop closed, operating to energize the coil of the oil switch and closing its contacts and energizing the constant-current transformer. In other words, the system is designed to assure positive control of the ON schedule.

If conditions should require positive control of the OFF schedule, a possible requirement under anticipated blackout conditions, a similar system could be used except substituting a type MR-30 multiple relay for the MRR-30 type and changing the connections for the "start" and "stop" push-button control. The type MR-30 multiple relay load contacts are normally open with the operating coils de-energized, so that control would require the "stop" button contacts "normally closed" and the start button contacts "normally open."

For protection against accidental open circuit on the lighting loop a conventional series protective relay is provided which operates to remove potential from the coils of the type AN oil switch in the event that a break in the lighting loop develops while the constant current transformer is energized.



REMOTE-CONTROL circuit permits switching of series protective lighting circuit from several independent stations; circuit is drawn with oil switch energized and lighting circuit energized; momentary closing of any "stop" button will kill the series circuit

•

Eight-way Wind Direction Indicator

By J. C. SMITH
Chief Plant Electrician, Electric Department, Rockville Center, N. Y.

A brush contact was provided on the shaft of a weathervane on the roof of the Rockville Center municipal plant as the first step in improvising an illuminated dial wind-direction indicator. Four commutator segments are connected to as many 18-volt switchboard lamps placed in the center of four quadrants formed by partitions in the white-painted case of a former round switchboard instrument.

When the wind is north the "north" lamp lights and illuminates the ground glass cover in only the N-marked quadrant. In order to show a NE wind the brush is made wide enough to have half the span of a commutator segment. Both N and E quadrant lamps then are energized and this signifies a NE wind.

The instrument was designed and built for us by L. V. Edwards, local instrument specialist. It has functioned perfectly.

QUICK TO PROTECT PRODUCTION
SLOW TO INTERRUPT PRODUCTION

THE NEW QUICKLAG
NOFUZE "De-ion" BREAKER

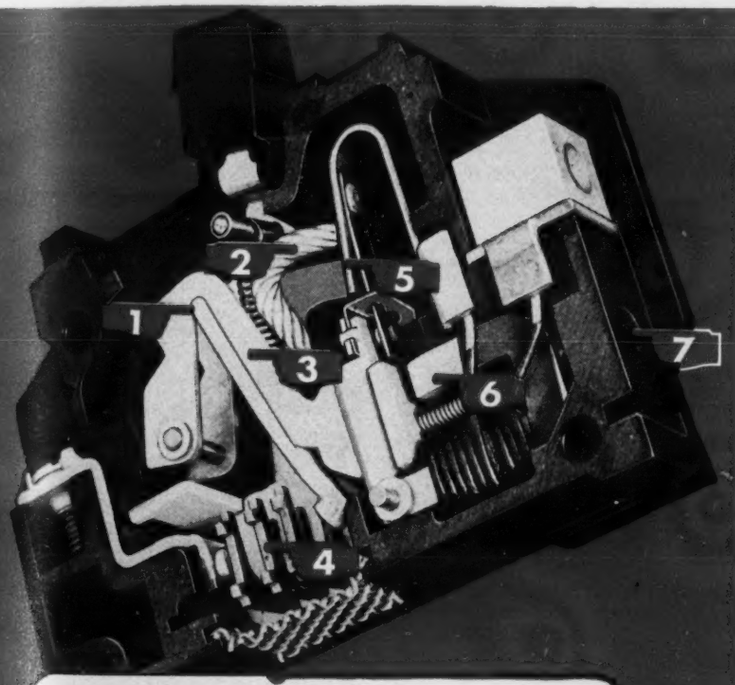
Like the "spotter" of enemy planes on the roof of a war production factory, the QUICKLAG circuit breaker keeps production moving as long as it is safely possible.

This new breaker successfully combines in a single unit a co-operative thermal-magnetic trip action—something never offered before in a protective device.

By this co-operative action, QUICKLAG meets all three requirements of modern lighting, appliance and fractional horsepower loads:

- **PREVENTS UNNECESSARY CURRENT INTERRUPTIONS** on harmless overloads.
- **PROVIDES MORE ACCURATE BURN-OUT PROTECTION** on sustained overloads.
- **INTERRUPTS SHORT CIRCUIT CURRENTS** as great as 5,000 amperes within 1/240th of a second.

Write today for your copy of "QUICKLAG" Bulletin 3146. It demonstrates with graphs how this new breaker gives practical protection for small wire sizes. Or ask your Westinghouse representative for a copy. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60517



WHY QUICKLAG IS MORE DEPENDABLE, STAYS ON THE JOB LONGER

1 **BEARING SURFACES ARE OF DISSIMILAR METALS** to insure against sticking and to reduce wear.

2 **HEAVY-DUTY FLEXIBLE SHUNT** is electrically welded, keeps wattage losses down.

3 **QUICK-MAKE, QUICK-BREAK** mechanism prevents "teasing" contacts.

4 **"DE-ION" ARC CHAMBER** minimizes arcing, increases contact life.

HOW QUICKLAG GIVES *GREATER* PROTECTION WITH *FEWER* INTERRUPTIONS

5 **BI-METAL THERMAL ELEMENT** provides accurately calibrated flexing action when heated, plus proper tension for spring action to restrain magnetic element on short-time overloads.

6 **ELECTROMAGNET ELEMENT** operates instantly on short circuits.

7 **ACCURATE CALIBRATION**—Calibrating screw provides accurate and uniform calibration during manufacture; is then sealed to prevent "tampering" after test.

SPECIFY QUICKLAG PANELBOARDS

Westinghouse builds QUICKLAG breakers in panelboards of the single-row type shown at left, suitable for H-beam mounting, and the double-row type for wall mounting. Other Westinghouse panelboards are available having combinations of QUICKLAG and 2 or 3-pole common-trip Nofuze "De-ion" breakers.

Westinghouse
NOFUZE
CIRCUIT PROTECTION

HOW TO PROTECT

SUBSTATION INSULATORS DURING MAINTENANCE

When housecleaning a substation, insulators must be given attention. And they must be protected while other apparatus is being inspected, cleaned, repaired and painted.

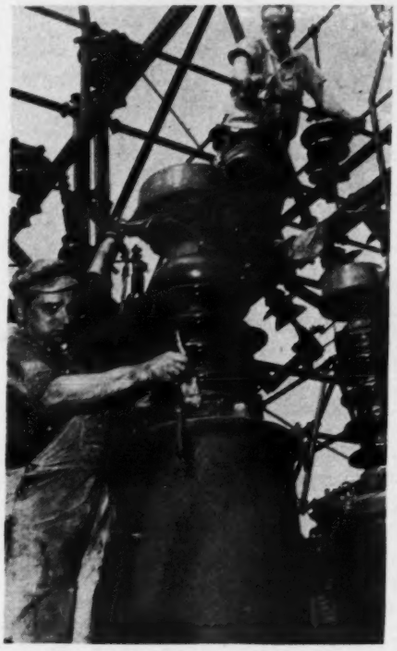
A method of protecting and cleaning insulators on two transformer banks at a 10,000-kva., 23,000/2,300-volt substation is shown in the accompanying illustrations.

The procedure was followed when a substation at the Westinghouse East Pittsburgh Works received a thorough housecleaning by maintenance engineers of Duquesne Light Company and Westinghouse Electric & Manufacturing Company.

1. **INSULATOR BUSHINGS** were coated with petroleum jelly for protection from paint spray. Coating also acts as a solvent of grease and dirt.

2. **AFTER** the petroleum jelly coatings were applied, insulator bushings were wrapped with cotton sheets as final protection against paint spray.

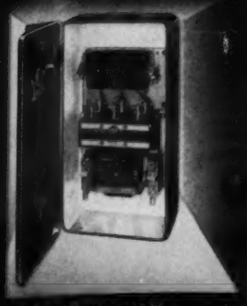
3. **BEFORE** being sprayed with a durable, weather-resisting paint, metal parts were cleaned of rust, dirt and grease by washing with a solvent.



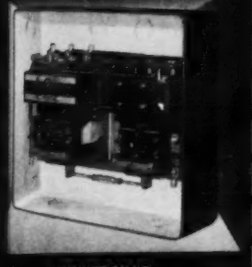
4. **HAND PAINTING** was necessary on metal parts close to bushings because of the danger that spray painting might penetrate protective coverings

5. **AFTER** the painting of adjacent parts was finished and protective coverings removed the transformer and other bushings were cleaned and polished

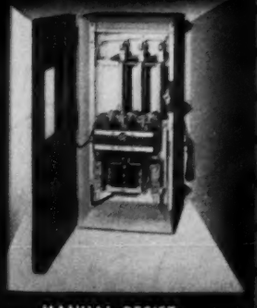
ACROSS-THE-LINE
SIZE 4 STARTER
for remote control.



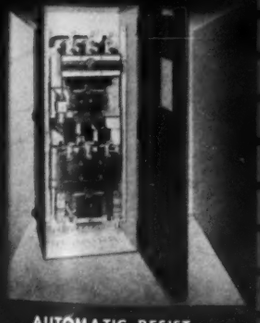
COMBINATION
SIZE 4 STARTER
Disconnect unit has double-break, silver alloy contacts.



REVERSING
SIZE 4 STARTER
Will handle the toughest reversing service.



MANUAL RESIST-
ANCE STARTER
Starts loads with velvet smooth acceleration.

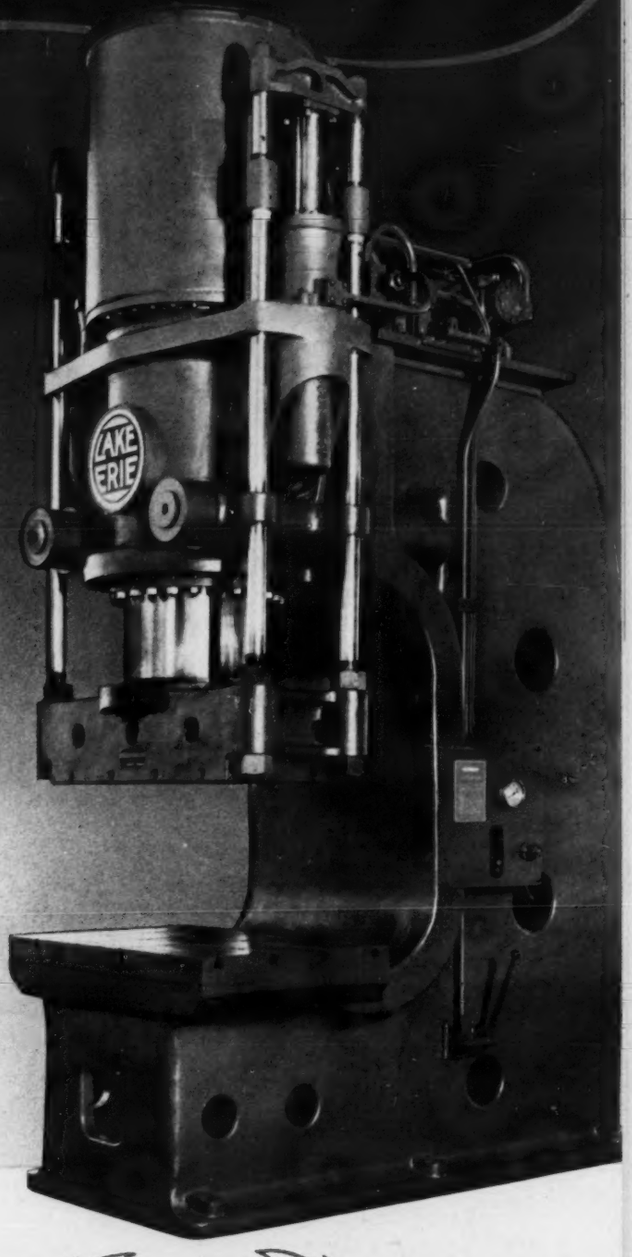


AUTOMATIC RESIST-
ANCE STARTER
Compression resistors assure smooth starting.

When you've got a **TOUGH** starter job . . . pick one of these

A-B SIZE 4 SOLENOID STARTERS

The husky Size 4 Allen-Bradley starters rated at 50 hp, 220 v, 100 hp, 440, 550, 600 v, are similar in design to the smaller Sizes 0, 1, 2, and 3 solenoid starters. The same simplicity... the same maintenance-free, double break, silver alloy contacts... the same dependable straight-line solenoid action... the same trouble-free performance. No other Size 4 contactor incorporates all of these features. Write for engineering bulletins.

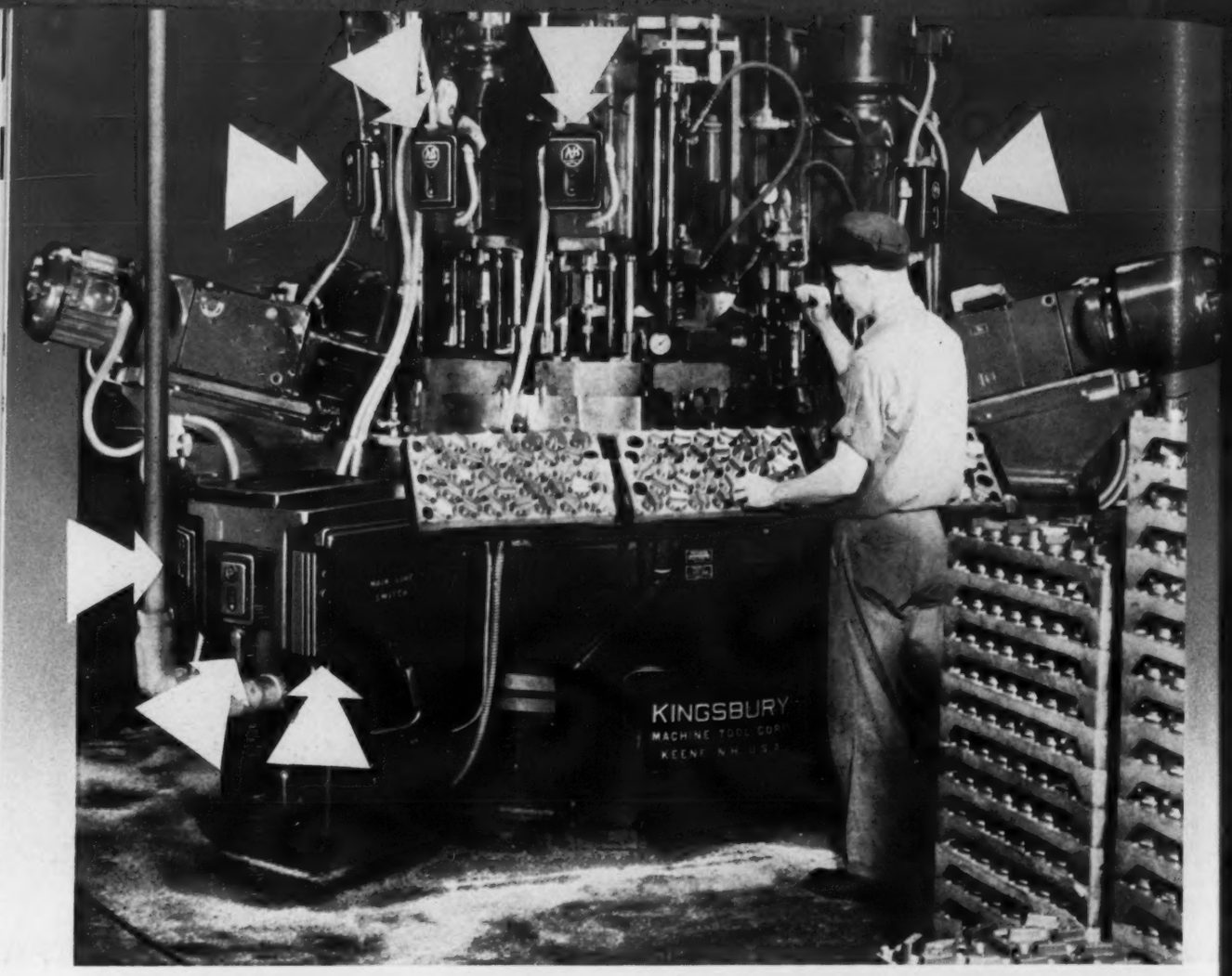


A-B

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

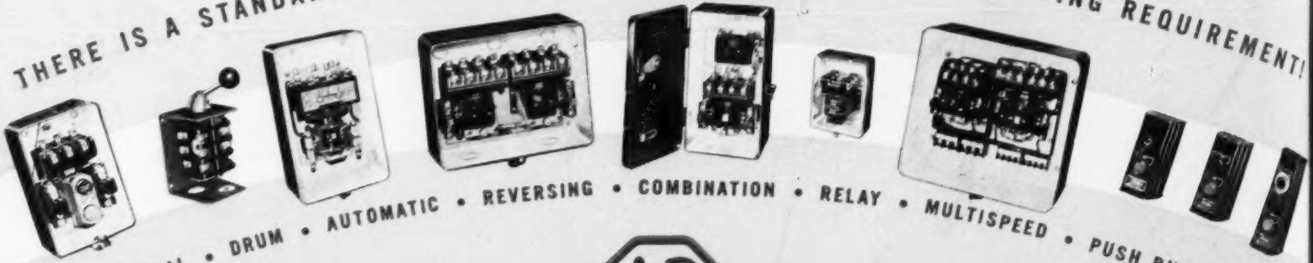


WHERE PRODUCTION IS A MUST... YOU'LL FIND ALLEN-BRADLEY CONTROLS

Production machines require automatic controls. For safe, positive sequence control, the contactors must perform consistently. No variations in opening and closing times can be tolerated. The precision operation of automatic machines depends upon the precision of their controls. Oscillograph tests of Allen-Bradley solenoid controls have repeatedly demonstrated their superiority in consistent switching performance. Their double break, silver alloy contacts never need maintenance. The absence of pivots, pins, hinges, and jumpers explains why they are good for millions of trouble-free operations. That's why you find A-B controls where Production is a MUST!

Allen-Bradley Company, 1327 S. First St., Milwaukee, Wis.

THERE IS A STANDARD ALLEN-BRADLEY CONTROL FOR EVERY OPERATING REQUIREMENT!



MANUAL • DRUM • AUTOMATIC • REVERSING • COMBINATION • RELAY • MULTISPEED • PUSH BUTTON

A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL FOR ALL INDUSTRY

Maintenance of Insulating Oil

VIII—Corrosion*

By L. M. LIMPUS
Superintendent of Reclamation
Oklahoma Gas & Electric Company

Corrosion attacks and eventually destroys most of the metallic substances exposed to a combination of acidic vapors and moisture condensation within the gas space above the oil level. The modern pressed steel tank cover, some of the older bushing flange cements, the uninsulated or poorly insulated sections of the multi-stranded apparatus cables and any untinned portions of brass bushing flanges are exceptionally vulnerable to corrosive assault. Corrosion appears in the form of paint and varnish blisters, deposits of white or green salts and concentrations of red and brown rust. It is a rather prevalent source of trouble and can be discovered only through visual inspection.

Fractures

Fractured relief-pipe diaphragms almost invariably result in the formation of corrosive deposits within the relief pipe if they are not replaced almost immediately after puncture. Conductive corrosive salts sometimes form a path along a bushing shank or apparatus lead, resulting in "flashover," large flakes of rust will fall from a path along a bushing shank terminal board or a tap changer, and free water often enters through the small holes in the cover or relief pipe which were eaten away by a corrosive deposit.

Oil tests will not disclose the presence of corrosion, but a long-handle mirror may be used in discovering a corrosive deposit without the necessity for removing more than the inspection plate. Whenever corrosion is discovered all trace of it should be removed, the cause definitely determined and adequate steps taken to prevent its recurrence. Although many paints and varnishes are corrosion-resistant, few, if any, are corrosion-proof. If the apparatus cannot be adequately sealed against the possible entrance of moisture, then the opposite strategem must be employed —the gas space must be sufficiently well ventilated to remove any concentration of acidic vapors and to prevent moisture condensation. Unless the gas space is rather small, double breathers must be employed, one at each extremity of the cover, in such a manner that dead air pockets will no longer exist. Oil replacement, using new acid-free oil, will relieve the corrosive condition only temporarily as corrosion forms at rather low neutralization numbers.

*This series began in the October 31, 1942, issue of "Electrical World."

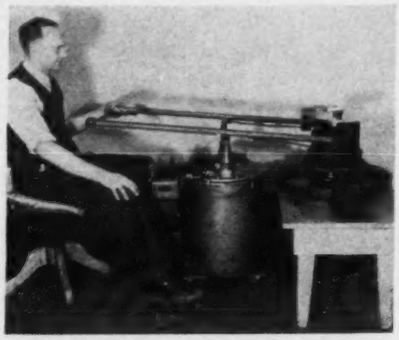
•

Makes Insulator Testing One-Man Job

A one-man method of testing high-tension, strain-type insulators, from 2,400 volts up, has been developed by the Northwestern Electric Company, Portland, Ore. In the picture the equipment is being used on a 66,000-volt insulator. The insulator is inverted as shown, the skirts being filled with water in the usual manner. The test is made at 35,000 volts from skirt to skirt, or 105,000 volts over all.

Formerly in making such a test one man would be required to make adjustment of the electrodes, while another man applied the potential from the transformer at the right moment and read the voltmeter. Aside from the fact that two men were required, there was conceivably an element of hazard where one man adjusted the electrodes while another applied the potential to them.

W. G. Garnett, meter man, shows how he executes the whole routine himself by means of the plow-handle-

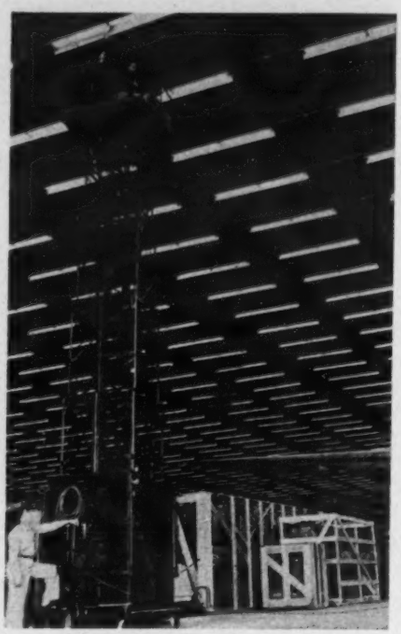


ONE MAN can test insulators by this means

like arms, centrally mounted in such manner as to enable him to apply the electrodes at the opposite end to the proper points from skirt to skirt. When they are properly adjusted he closes the switch with his foot and reads voltmeter directly in front.

Lamp Servicing by Telescopic Platform

Relamping and servicing of thousands of lamps has been stepped up by use of a motor-driven telescopic platform in the plant of the Vega Air-

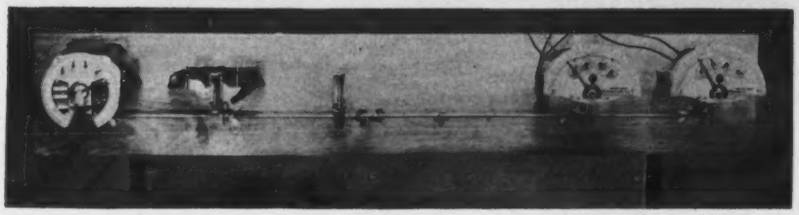


TELESCOPIC PLATFORM carries servicing crew to fluorescent lamps in high bay areas

craft Corporation at Burbank, Calif. The lighting fixtures, each of which contains four 40-watt Westinghouse fluorescent Mazda lamps, provide approximately 33 ft.-candles of illumination at working levels, 24 hours a day, to help speed the production of Vega Ventura bombers and B-17's for the United States.

The mobile telescopic platform carries two members of the three-man service crew high in the air for servicing the lamps, which are 35 to 40 ft. above the floor in high bay areas. The fixtures are mounted in rows approximately 8½ ft. apart, and are 10 ft. apart, from center to center, in each row.

About 30,000 of the 40-watt fluorescent lamps are used in the Vega plant. Mounted in various high bay areas, some 18,000 lamps are serviced by the telescopic platform such as the one which is shown in the accompanying illustration. It is used in areas not served by overhead lamping bridges which travel on existing crane rails.

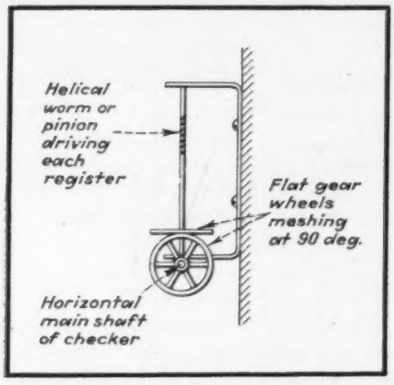


SHOP-FABRICATED demand meter register checker. Sangamo registers, left, fasten to portion of grid mounted to engage worm G.E. registers, at right

Universal Checker for All Demand Registers

Shown is the shop-fabricated demand meter register checker used in the meter laboratory of the Central Illinois Public Service Company, Ill. This checker has a potential capacity of six registers, although at present it is equipped to handle only four, two Sangamo and two General Electric.

Departure of this device is the fact that it can be used to check any make of register. This is possible by virtue of separate vertical shafts at each register position. Each is mounted in a simple metal clip and driven from the horizontal main shaft of the checker unit by two flat gear wheels meshing at 90 deg., one on the main shaft and the other on the vertical shaft of the worm. These worm shafts are standard meter shafts with a special side-thrust lower bearing.



SEPARATE worm shaft at each position is driven by flat gear wheels from main shaft

Because most register checkers are built for a single make of register, the helical worm or pinion is usually machined on a vertical main shaft. A gear in the register engages this main shaft to drive the register mechanism. It is difficult to adapt them to universal use because of different register motor arrangements. In the device shown, however, ability to check any type register lies in providing a separate worm shaft for each position, an appropriate register mount and of course the proper gear ratio for driving the vertical shaft from the main shaft.

Motor driving the main shaft of the device shown is a 110-volt, 1-r.p.m. synchronous-induction motor (G.E. type 5SMY20J14). The motor has been altered to deliver 25 r.p.m. to the main shaft through 1:1 bevel gears from a type S Sangamo demand meter. Shaft of the checker is 30 in. long and made from $\frac{1}{8}$ in. welding rod. Gears to drive the separate vertical shafts at each of the six positions are attached to the main shaft by disk hubs from Sangamo time switches.

At each of three of the positions the ratio of the gears driving the vertical shaft is 1:1 and in the other three cases 25:30.

Both 110 volts and 220 volts for the register motors is provided by an auto-transformer mounted on the back of the unit.

Mounting the Sangamo register with its overhanging motor on the device so that it would engage the worm was accomplished by sawing off the top portion of a mounting grid and mounting it on the face of the checker. The register mounts on this abbreviated grid and engages the worm shaft with ease.

The G.E. registers are mounted on studs taken from the regular shipping frames.

•

Cleans Jewels Safely With Tetrachloride

Carbon tetrachloride is an effective agent for cleaning watt-hour meter jewels, but its vapor is not particularly healthful to breathe. Different ways of removing this difficulty in the use of carbon tetrachloride are to be seen in various meter laboratories; one of the simplest and most satisfactory is that of the Philadelphia Electric Company.

On the top of each jewel inspection desk in this laboratory is a funnel-shaped exhaust intake with an opening about 5 in. in diameter. Back in the center of the funnel is a small nozzle pointing forward. Attached to this nozzle is a jig in which the operator places and holds the jewel. A small high-velocity spray of tetrachloride or a blast of compressed air, as determined by the operator, comes from the nozzle.

The control mechanism is operated by a spring-return foot treadle under the desk. Moving the treadle part way causes the air blasts to blow foreign particles off the jewel face; pushing it all the way down adds tetrachloride spray to the air blast; releasing the treadle part way dries the jewel. And while this is going on the exhaust duct is pulling air into the funnel, thus preventing the release of tetrachloride vapor into the room. The amounts of chemical and of compressed air used are very small.

•

Abnormal Load Conditions on Bus*

By WILLIAM DEANS
Chief Engineer
I-T-E Circuit Breaker Company, Philadelphia

The temperature limits of bus conductors described in the preceding article correspond to full load or rated load for the bus. When short-circuit currents flow through the bus naturally a very much higher temperature must result, because of the very much higher currents.

Standard practice recognizes a maximum temperature of 300 deg. C. as the maximum allowable for determining short-time ratings of power switching devices and such equipment and, therefore, for electrical buses. At that temperature the physical characteristics of copper, aluminum and silver begin to approach the undesirable values.

Equations have been developed showing the relation between the current, the area of cross-section of the conductor, the final and initial tem-

*This is the fourth in a series of seven articles on the general subject of bus design, which began in the December 26, 1942, issue of "Electrical World."

WHY YOU ARE NOT GETTING MARMON-HERRINGTON *All-Wheel-Drive* TRUCKS

• Getting Marmon-Herrington *ll-Wheel-Drive* Trucks for any nd of civilian service is almost mpossible now—and it is easy to nderstand.

We appreciate, as well as you, at many civilian jobs are as es-ntial to the successful prosecu-on of the war, as those of the ilitary—*but, in time of war, the military comes first.*

And shortage of trucks is only half of the story. By far the greater proportion of our factory space and facilities is taken up in the production of tanks and other military vehicles—some of which we are not at liberty to mention.

That is why we are asking all our friends — dealers and users alike—to have patience, to take the best possible care of the Marmon-Herrington equipment you have, and to buy U. S. War Bonds to the limit of your capacity. By so doing you can help your country, yourselves and us—in our combined efforts to win the war and return to our normal pursuits with the least possible delay.

MARMON-HERRINGTON

All-Wheel-Drive

MARMON-HERRINGTON CO., Inc., Indianapolis, Indiana

Cable Address: MARTON

peratures and the time during which the current flows. Several such equations are:

Equation (1) is a general equation applying to any material:

$$I = 1.93 \times 10^8 A \sqrt{\frac{W}{R_s t} \log_{10} \frac{\theta_2 + a}{\theta_1 + a}} \quad (1)$$

In above and subsequent equations the following apply:

R_s = Resistance in ohms per cir.mil foot per degree absolute temperature on Centrigrade scale
W = Heat capacity per cir.mil foot per degree Centigrade scale in joules
θ = Centigrade temperature
t = Time in seconds
I = Current in amperes r.m.s.
A = Area of the conductor in square inches
a = "Inferred Zero," basis for a particular material

For copper of 99 percent conductivity equation (2), which is derived from (1), applies. Equation (3) is derived from (2) and applies to copper of 99 percent conductivity, and with further limitation that the initial temperature is 40 deg. C. and the final temperature 300 deg. C.:

$$I = 0.22 \times 10^8 A \sqrt{\frac{1}{t} \log_{10} \frac{\theta_2 + 234}{\theta_1 + 234}} \quad (2)$$

$$I = 11.7 \times 10 A \sqrt{\frac{1}{t}} \quad (3)$$

For aluminum equations (4) and (5) apply; they are similar to equations (2) and (3) for copper:

$$I = 0.144 \times 10^8 A \sqrt{\frac{1}{t} \log_{10} \frac{\theta_2 + 228}{\theta_1 + 228}} \quad (4)$$

$$I = 7.2 \times 10^4 A \sqrt{\frac{1}{t}} \quad (5)$$

(for $\theta_2 = 300$ and $\theta_1 = 40$)

For silver equations (6) and (7) apply and are similar to equations (2) and (3) for copper:

$$I = 0.193 \times 10^8 A \sqrt{\frac{1}{t} \log_{10} \frac{\theta_2 + 243}{\theta_1 + 243}} \quad (6)$$

$$I = 10.2 \times 10^4 A \sqrt{\frac{1}{t}} \quad (7)$$

(for $\theta_2 = 300$ and $\theta_1 = 40$)

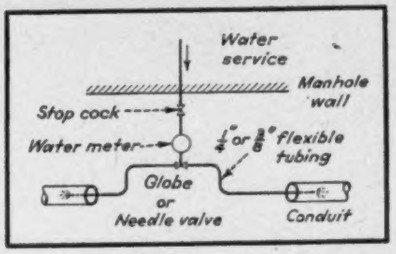
These equations have been derived upon the basis that the increase in resistance with rise in temperature has been duly considered and, furthermore, it has been assumed that the time during which the current flows and, therefore, produces heat, is so short that there is no loss of heat from the conductor by any means. All the heat developed by the action of the current is assumed to remain in the conductor.

Survey Possible Cable Cooling Methods

During the summer and early fall of 1940 an abnormal number of cable and joint failures was experienced in a group of ten 33-kv. cables carried in a ten-duct conduit of the Union Electric Company of Missouri at St. Louis. The failures resulted from localized deterioration of the cable insulation by loading heavier than previously carried, coupled with unusually dry and hot soil conditions.

Periodic flushing of the conduit, which was 40 sections long, produced temporary relief, but lost its effectiveness within a few hours. Ice and dry ice in manholes cooled the manholes, but had little effect a few feet away.

Several artificial cooling methods



SCHEME of water connections at manholes used for cooling underground power cables; after passing through cable duct water is discharged to the sewer at the next manhole

were investigated, among them (1) forced air, (2) forced air with ice in the manholes, (3) saturation of the soil surrounding the conduit, (4) greater frequency of flushing the ducts and (5) installation of water connections in manholes to provide a continuous controlled flow of water over the hottest cable in each section. Estimates indicated the last named to be the most practical, effective and economical method, both in installation cost and operating costs.

Early in the summer of 1942 water connections were installed in 38 of the 50 manholes involved. The water passes through a stop-cock and meter in each of the 38 manholes, thence through a globe valve, and through ¼-in. or ⅜-in. tubing into the duct carrying the selected cable. Experience has shown that a needle valve would have been preferable to the globe valve. Where practical, sections in both directions are served from each water connection.

Cool, moist soil conditions in 1942 prevented any actual demonstration of performance under extreme conditions, but tests show that allowing a 30 deg. F. temperature rise in cooling water a flow of one gallon per minute removes about 20 percent of the losses in a 400-ft. conduit section. By varying the rate of flow and by passing water over additional cables in each section cable sheath temperatures can be held to any reasonable limits desired. Tests of the actual installation have confirmed the advance estimates as to temperatures and operating cost.

Alternate Methods

Several alternate methods of cooling were studied and are discussed briefly here:

Forced Air Cooling—Use of exhaust fans installed in the manhole entrance and drawing air through the ducts in both directions was considered. Since one watt hour will heat 250 cu.ft. of air about 1 deg. F., about 50,000 cu.ft. per hour would be required to remove all losses (estimated at 8,000 watts) in a 400-ft. section of ten-duct conduit, allowing a 40 deg. rise in air temperature. An available fan was estimated to be capable of drawing 10,000 cu.ft. per hour through one 400-ft. section of ten-duct conduit (4¼ in. duct, 3¼ in. cable). This, it was estimated, would remove 20% of losses or effect a 4½ deg. C. reduction in sheath temperature. Cost was but little lower for 20 installations than that for water cooling.

Forced Air Cooling With Ice—If air passed over blocks of ice placed in intermediate manholes between fans a better cooling effect might be had. It requires 128 B.t.u. to melt a pound of ice and raise the water temperature to 80 deg. F. For 300 lb. of ice 38,400 B.t.u. are required. With 0.293 watt-hour equal to 1 B.t.u. a total of 11,200 watt-hours are required for the same rise. If air intake is at 90 deg. F. and 10 deg. reduction allowed for cooling by ice, the total air intake (both sections) of 20,000 cu.ft. per hour will melt 300 lb. of ice and raise water temperature to 80 deg. in 14 hours. Melting the ice (assumed at a uniform rate) equivalent of 800 watts would be delivered to the ice and be available for cooling the cable. Raising the air temperature from 90 to 130 deg. F. removes another 3,200 watts per hour. The total of 4,000 watts per hour would be about 25 percent of the total losses of two sections and the percentage reduction in cable sheath temperature would be 12½ deg. F. or 7 deg. C. Cost again would be higher than that for straight water cooling.

Saturation of Soil—During the summer of 1941 water was run through a drain tile above the conduit and allowed to seep through the joints of the tile, raising the moisture content and thus the heat-conducting qualities of the surrounding soil. This conducted heat away from the conduit faster than the dry ground, but in loose soil presented the danger of cave-in. It was also found that some water seeped through and entered the duct, reducing the temperature of the cable by bringing the water in contact with the cable sheath. On the basis of data available this method where tried caused a decrease of 4 deg. C. in the cable sheath temperature. About eight or ten hours was required for temperature to return to normal.

Protection... AGAINST BOILER HEAT OR BLIZZARD COLD

Your motor starters may never have to cope with such extremes in temperature, but even *normal* variations will affect the operation of across-the-line starters unless they are equipped with *compensated* overload relays.

Only 5¾" x 5¼" x 4⅛"

These seemingly small overall dimensions are the result of precision engineering to give you a top-performance starter that can be installed in small spaces. Fully approved by Underwriters' Laboratory.

Five sizes are available . . . 1.5 to 7.5 H.P. 110 to 550 V (A.C.)

The New Monitor THERMALOAD V SOLENOID STARTER

is a definite achievement in starter design and construction. Included in its many tried and proven features is the famous Monitor Compensated Thermal Overload Relay . . . . in order that extremes in ambient temperature will not affect its performance.

Thus, you get full overload protection for your motor under all kinds of installation characteristics . . . . the trip always occurs within the same time at a given percentage of overload.

Look at this line-up of Thermaload V features: Vertical, Straight Line Design . . . . Resilient Shock-Proof Mounting for quiet operation . . . . Double Break Silver Contacts . . . . Easily-Interchangeable Coils for different voltages . . . . and the desirable Monitor Compensated Thermal Overload Relay. Never before have so many features been built into one starter. No wonder the Thermaload V is recommended for both original equipment and replacement.

Write your Monitor field engineer for further details and delivery dates.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

LOAD SERVICING

Industrial • Commercial • Rural • Residentia

Home-Made Drag Saw Cuts Farm Firewood

An electric drag saw, powered by a ¼-horsepower motor and constructed from odd materials found around any farm, has been constructed by the experimental laboratory of the Puget Sound Power & Light Company, Seattle, Wash. It was built from a model designed by the University of Tennessee Agricultural Engineering Department. It can be operated at a cost of about 3½ cents for ten hours of service.

Originally, the plan called for an old tire to be mounted on the automobile wheel. Because of the rubber shortage, Puget Power engineers substituted a "tire" built up of wood.

Any automobile front wheel and spindle may be used. A plate is either bolted or welded to the spindle so that it can be bolted on a timber 2 x 6 in. x 3 ft. long. A 13-in. arm is bolted or welded on the wheel and the wheel, motor and saw are mounted as shown in the picture. One end of the 2 x 6 in. is supported by legs and the other end is fastened to the log by a sharpened fastening bar. In hard woods, a small lag screw may be necessary.

Cuts are started with a hand saw or slotted saw guide attached to the log or to the 2 x 6 in. The saw cut must line up with the auto wheel. The bar driving the saw should be about 3 ft. 6 in. long. Although picture shows it as being made from pipe, hard wood is a fair substitute. It is fastened to the crank by a bolt which fits loose in the bar and is held firmly by nuts on each side of the crank. Weights on the bar end of the saw make it cut faster.

The V-pulley on the motor should not be over 1½ in. in diameter and an 8-ft. 9 in. V-belt is required. The direction of rotation must be so that the saw is pushed toward the log at the top of the stroke. For the most satisfactory results the saw must be sharpened evenly and have plenty of "set." A 4 ft. or 5 ft. saw works best for this unit. When moving the saw to a new location all that is necessary is to remove the belt, invert the saw and wheel it on its wooden tire to the new location.

DRAG SAW, powered by ¼-hp. motor, made from parts available on most farms

Exchange Plan Puts Appliances to Work

A recent short-term appliance e change activity conducted along th lines of a "white elephant" sale i the southern division of the Okl homa Gas & Electric Company di closed one very telling point. It re vealed that many who brought "un wanted" appliances to the dealer store for exchange decided to kee the appliance after all, once it ha been repaired and readied for sale This carries the strong inference tha unwanted and inactive appliances are in a great many cases, so designated by customers because they are i disrepair. They quickly become de sirable in the customer's eyes when the source of irritation has been removed.

Exchange Basis

Primary purpose of the plan, tried on a limited scale in the town of Ard more, Okla., was to give customers an opportunity to exchange their "un wanted" appliances for ones which they really wanted. Each appliance turned in for exchange was rated on a point basis according to the follow ing list.

Sales points were also allowed as a bonus.

Appliance	Points
Cooker (roasters)	5
Junior cookers	2
Broilers	2
Waffle bakers	2
Sandwich toasters	2
Table stoves (double)	2
Table stoves (single)	1
Mixers	2
Toasters	1
Coffee Makers	1
Egg poachers	1
Biscuit bakers	1
Clocks	1
Corn poppers	1
Sweepers	2

The total number of points credited

nother "SERVICE" from Kelvinator!

vinator's "Simplified Training Course for Service Men" Enthusiastically Received by Dealers and Utilities as a Timely Contribution to the Refrigerator Industry!

king ahead, early in 1942, Kel-tor foresaw the growing short- of refrigerator service men, the need to fill their ranks trained replacements.

a sincere effort to be of ser- to the refrigerator industry, inator created and made avail- last fall, to all dealers and ties a "Simplified Training rse for Service Men"—for *all* es of refrigerators!

iefly, it's adaptable for use r by utilities with large train- chools, or by one-man service os in small towns. Study of the page "Training Course" and the "Trouble-Shooter's Guide" should enable anyone to be trained in a very short time to diagnose refrigerator troubles and to repair them, regardless of make.

Total cost of the Training Course is twenty-five cents . . . the handy Trouble-Shooter's Guide is five cents . . . priced only to control distribution. The Instructor's Manual is supplied free for group training.

For copies of the Simplified Training Program material, contact your local Kelvinator distributor or zone—or write direct to Nash-Kelvinator Corporation, Detroit, Michigan.

Hundreds of Letters Complimenting Kelvinator On This Forward-Looking Program Have Been Received from Dealers and Utilities

BUFFALO, NEW YORK:
". . . an excellent piece of work . . . invaluable for instruction of needed service personnel."
SCHWEGLER BROS., INC

INDIANAPOLIS, INDIANA:
"The industry owes another debt to Kelvinator . . . for service rendered to the electric refrigerator user."
INDIANAPOLIS LIGHT & POWER CO.

MIAMI, FLORIDA:
"No other training material could possibly fill such a large and immediate need."
FLORIDA POWER & LIGHT CO.

SAN ANTONIO, TEXAS:
"The course will improve the efficiency of the service man."
WESTBROOK COMPANY

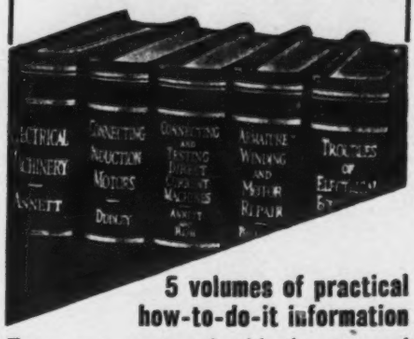
LOS ANGELES, CALIFORNIA:
". . . represent the finest contribution to the service problem we have yet seen."
PACIFIC COAST ELECTRIC ASS'N.

SCRAP IS POWER
Cooperate With Your Industry!
Salvage All Inoperative Parts Containing Critical Materials..
Put Vitally-Needed Scrap Back into the Scrap TODAY!

LOOK AHEAD WITH **KELVINATOR**

DIVISION OF NASH-KELVINATOR CORPORATION, DETROIT, MICH.

Every phase of electrical maintenance and repair work covered in this Library



5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench of a Wheatstone bridge.

Includes trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

EXAMINATION COUPON

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Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

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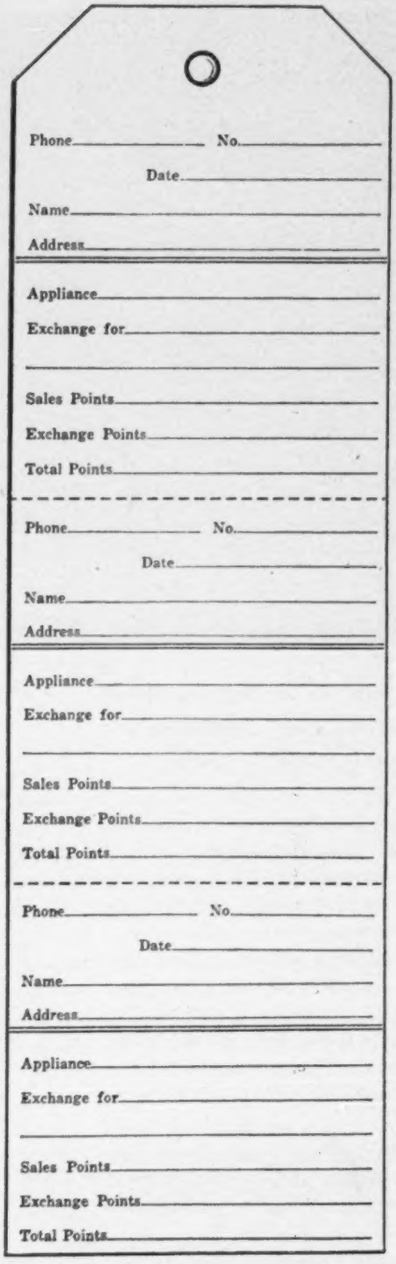
to a customer for an exchange appliance were used as a medium of exchange. When the appliance was purchased the buyer paid into a fund a sum of money corresponding to the points called for. The original customer could then apply these points toward the purchase of additional new merchandise or take the cash when the appliance was disposed of.



TRIPLICATE TAG used to record sale and exchange points credited to customers on appliances turned in for trade

In handling the appliances a triplicate ticket was used. One part was detached and given to the customer, the second part was kept by the utility company and the third attached to the appliance itself. No appliance was exchanged until it was put in good condition. This work was done by the dealer who sponsored the exchange. The customer paid for materials only, labor cost was carried by the utility.

As stated, most of the customers who turned appliances in for exchange decided to keep them after they had been repaired. As a result many appliances were repaired, but few were actually exchanged.

The activity was conducted for three weeks and an average of sixty appliances per week were repaired in the one town of Ardmore (population 17,000), where the plan was first tried. The company believes that it is best to place a time limit on such exchange plans and three or four weeks is considered suitable.

In addition to appliances, it is estimated that around 100 old-style floor and table lamps brought in for exchange were converted and returned to use. This work was done by the local home service director who directed the entire activity.

It is recommended by the Oklahoma company that home service personnel be trained to handle similar activities and that they visit customers' houses during the activity to show customers how simple it is to repair smaller appliance defects and to encourage them not to be hasty in returning.

•

Customers' Accounts Sent Sans-Envelope

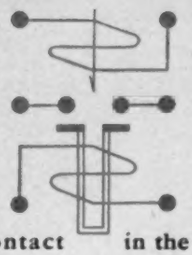
A plan has been developed by some utility companies in England to save tons of paper, by discontinuing the use of envelopes when sending accounts to their customers. The methods employed by two utilities have been reported in a recent issue of the *Steam Engineer* (England).

The Metropolitan Electric Supply Company is sealing its bills with a very small square of gummed paper, thus saving approximately 400,000 envelopes per year. Other companies are reported to be adopting this war economy.

London's Gas Light & Coke Company will change over to a tuck-in,

DUNCO "MEMORY" RELAYS

MECHANICAL LATCH-IN ELECTRICAL RESET



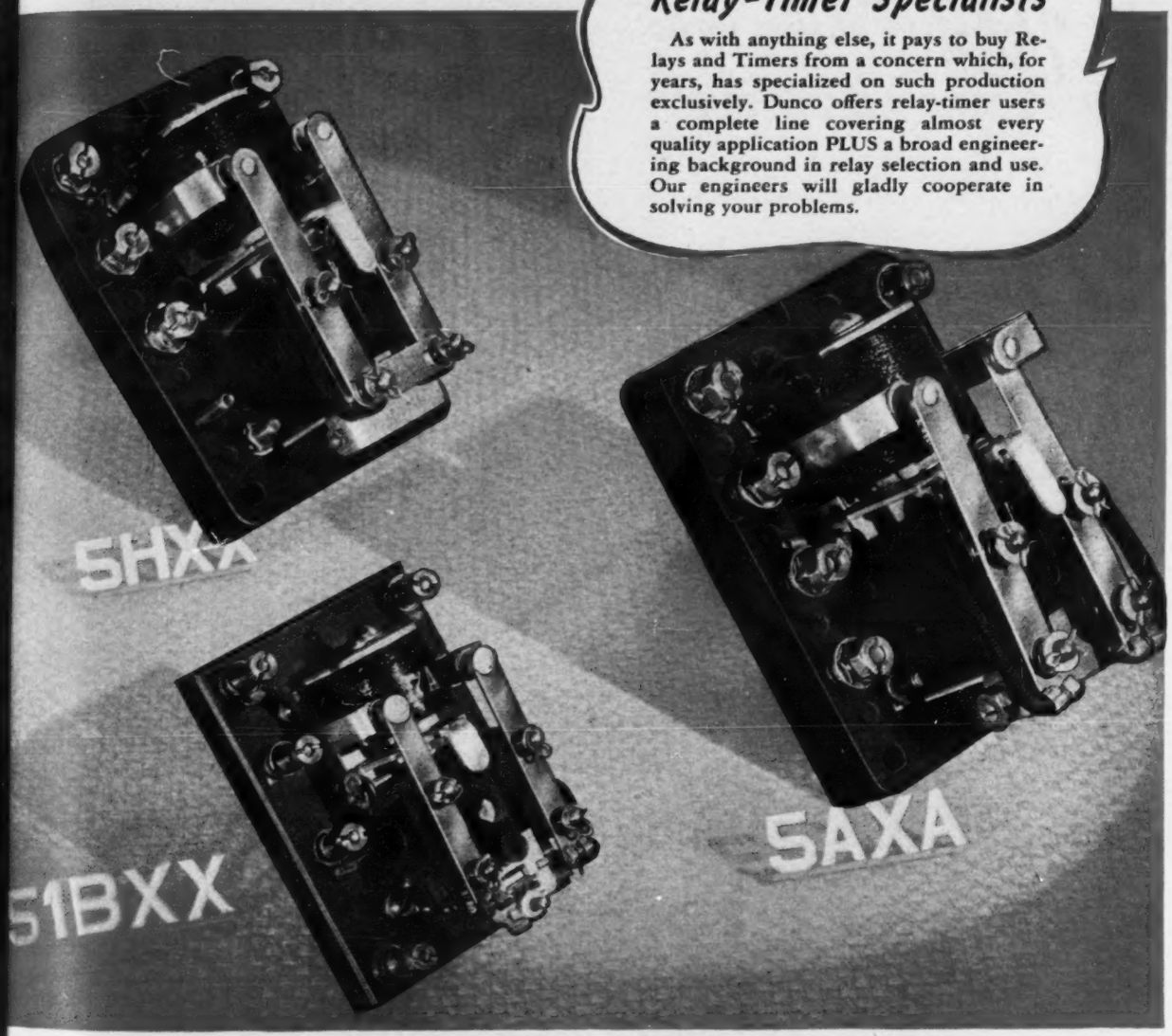
A Dunco Mechanical Latch-in, Electrical Reset Relay never forgets!

Energizing the lower coil closes the armature which is automatically latched in place until it is re-opened by energizing the upper coil. Thus, the contact "remembers" unfailingly which coil was last energized, and remains in position until it is released by energizing the other coil.

These units are made in both the large (Series 5) and "midget" (Series 51) sizes and with practically any contact arrangement that may be required. Together with hundreds of other Relays and Timers for a wide variety of uses, they are described in the 48-page Dunco Catalog and Relay Data Book. Copy gladly sent upon request. Please mention company connection.

Relay-Timer Specialists

As with anything else, it pays to buy Relays and Timers from a concern which, for years, has specialized on such production exclusively. Dunco offers relay-timer users a complete line covering almost every quality application PLUS a broad engineering background in relay selection and use. Our engineers will gladly cooperate in solving your problems.



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LET DUNCO DISTRICT ENGINEERS IN 28 CITIES HELP SOLVE YOUR RELAY-TIMER PROBLEMS

RE-LIGHTING

the new manpower / production *requirement*

Vital to plants built and lighted for daylight operation

Most plants operating today were designed and built for peacetime, *daylight* working schedules. Wartime production demands night work. *Lighting based on daylight conditions is inadequate to serve the needs of night workers.*

Night production is generally acknowledged to be anywhere from 20% to 40% less efficient than daytime production. And poor lighting, with its consequent eyestrain, fatigue, and lower working efficiency, is a major cause of this slump.

Re-lighting for 24-hour-a-day war production is the easiest, most economical remedy for this condition. Re-lighting does not mean discarding your present lighting system. It merely means bringing the equipment you have up to date by relocating lamps to eliminate glare and shadow; increasing lamp wattages, re-spacing lamps, installing additional equipment to insure uniform lighting levels throughout your plant. A Silv-A-King lighting engineer can tell you exactly.

Silv-A-King has specialized on industrial lighting for 21 years. Silv-A-King quality equipment (fluorescent or incandescent) plus a Silv-A-King "engineered layout" makes an unbeatable combination.

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1035 Metropolitan Avenue, Brooklyn, N. Y.

Send for your copy of our 16-page book: "Light Is An Essential Production Tool"

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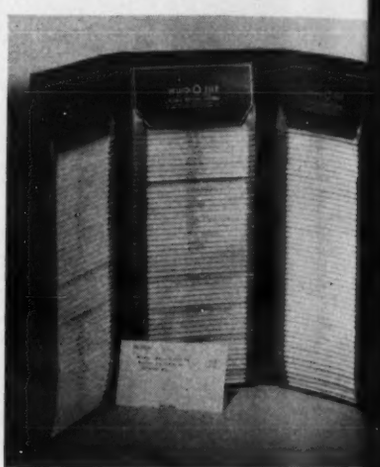
envelope-less account just as soon present envelope stocks are exhaust This plan should save 2,000,000 velopes per year.

•

Quick Servicing Aided by Repair Index

To speed up replies to queries as where disabled electrical appliance may be repaired, the Hartford Electric Light Company made up a number of file units for main and branch office service on which are record the names, addresses and telepho numbers of manufacturers' agen dealers and other concerns availab for this purpose. The company its at present repairs electric rang water heaters and commercial coo



FOLDING INDEX for counter use gives stant answer to queries about applia repair organizations

ing equipment, and is so listed. date about 105 index pockets are u ized in the index, and covering concerns handling air conditioni oil burner and "Iron Firemen" uni 18 which will maintain electric frigerators, 23 vacuum cleaner pairers, 42 washer and ironer clas fications, small appliances and oth equipment.

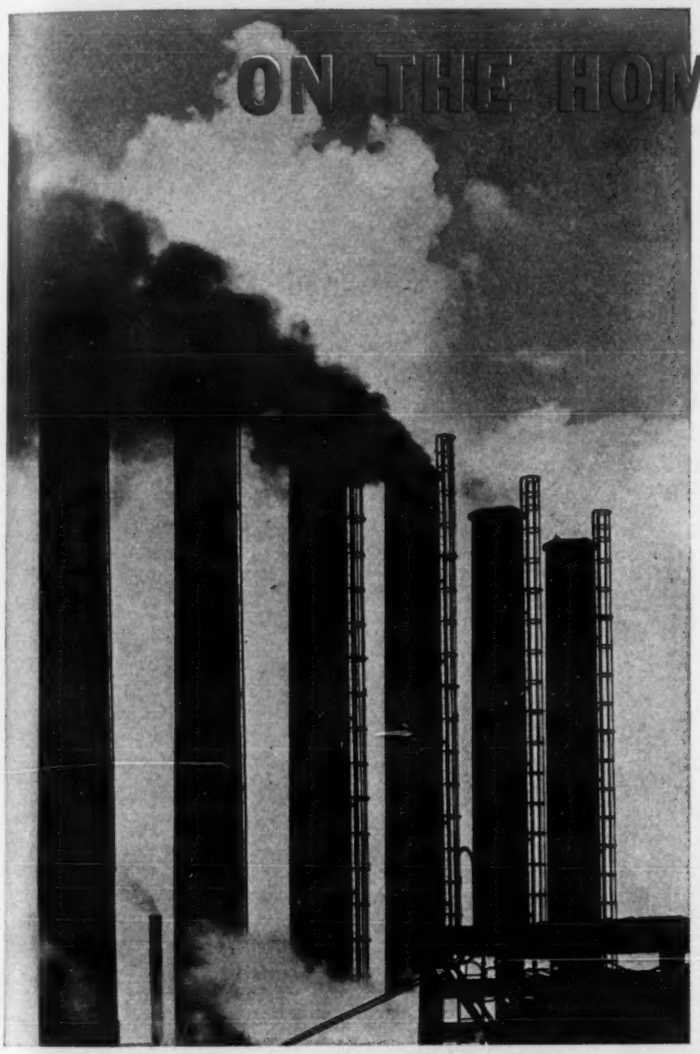
The main and each branch office the company carries one or more these unit files, which occupy li space because of being folded. The dividual devices are indexed on ca as shown, and changes can be ma in the listings and pocketing of ca with the greatest ease. The folder u was supplied by the Newport Sp cialty Company, New York.

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE

CRESCENT

is Helping to Win This War



ON THE HOME FRONT, TOO

In thousands of factories and shops whose production is devoted 100% to the war effort, power is supplied through CRESCENT Wire and Cable.

CRESCENT INSULATED WIRE & CABLE CO.

Ask Your Jobber For

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

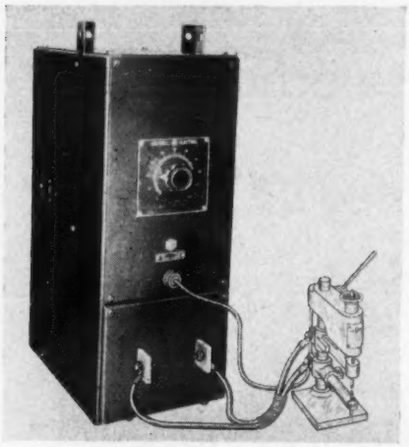
CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

NEW EQUIPMENT

Welding Control

Synchronous control for the operation of resistance-welding machines is furnished in two types: "CR7503-A136," shown, which



Type "CR7503-A136" half-cycle electronic spot-welding control panel with bench welder (sketched) connected. **General Electric Co.**, Schenectady, N. Y.

includes a welding transformer and is designed for bench mounting, and "CR7503-A133," without a transformer, designed for wall mounting. Both types can be used either with tongs or with a bench welder. The new design incorporates heat control by the phase-shift method and features a new tube, the "GL-415," which is said to make higher-speed welding possible.

•

Varnish

"Synthite PX-5" black baking varnish. **John C. Dolph Co.**, 168 Emmett St., Newark, N. J.

Recommended for use on stationary and revolving units constructed with class "B" insulating materials, new insulating varnish is said to possess the essential bonding properties to hold magnet wire and insulating materials intact under centrifugal force developed by high-speed unit windings. When used on flexible armature coils, each application of varnish requires from 1½ to 3 hours baking, depending on temperature and actual cross-section or depth of construction. Suitable for applications by atmospheric dipping and vacuum impregnation methods, the varnish may be used in all types of baking ovens, or with heat lamp baking equipment.

•

Crimping Tool

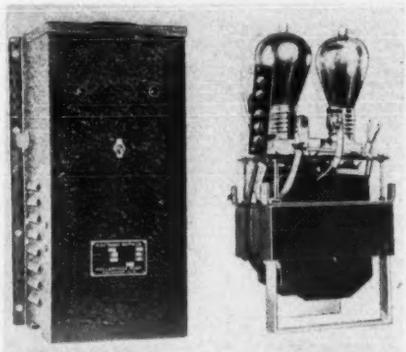
"Diamond Grip" insulation support terminal and crimping tool; wire sizes No. 22 to No. 14. **Aircraft-Marine Products, Inc.**, 286 North Broad Street, Elizabeth, N. J.

Solderless terminal slips over end of wire and is attached by crimping of sleeve section over insulation and conductor. Three crimps at one time are provided by a hand die operated similarly to pliers. Visual inspection can be made, it is claimed, of every finished connection.

•

Rectifier

Rectifier in enclosing case can be used for operating individual grinders, magnetic separators, magnetic chucks and other machine tools requiring direct current.

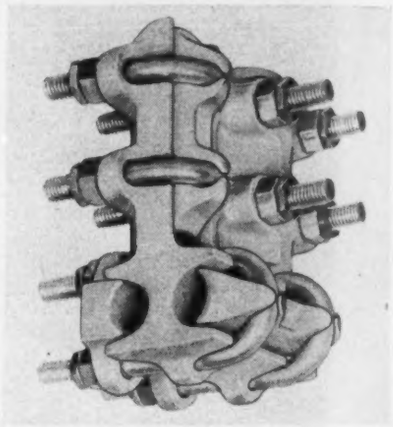


Electronic rectifier; connects to 440- or 220-volt a.c. power line and converts to 110- or 220-volt d.c. **Mellaphone Corp.**, Rochester, N. Y.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Connector

To provide facilities in connecting and terminating multiple cables, high-compression solderless cable fittings are available



Multiple cable connector; accommodates cable sizes up to 1,000,000 cir.mil; shown, for two 500,000-cir.mil cables on both main and tap. **Delta-Star Electric Co.**, 2400 Block, Fulton St., Chicago, Ill.

in tees, straight connectors and cable to flat bars or tubing types.

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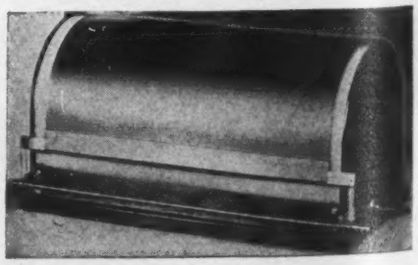
Copy Machine

For use in engineering and drafting departments, also executive, sales and administrative departments, photocopy machine has been developed to produce photo-exact copies of blueprints, specifications, or other records, without use of dark room.



"Apeco" photocopy machine; size of copies up to 18 x 22 in., operates on a.c. or d.c. circuits. **American Photocopy Equipment Co.**, Dept. 104, 2849 North Clark Street, Chicago, Ill.

A CENTURY OF SERVICE

When, at midnight on December 31st the clock chimed twelve, and we passed into the year 1943, then did Hubbard and Company enter its second century in business. We think it is excusable to believe that such survival and notable growth could only be possible for an institution built on solid foundations with a steadfast policy of honest service in all its ten decades of existence.

That past generations of "Hubbard" men have done a splendid job is attested by the Present. We owe all to their courage, devotion and inspiration. We of the Present cannot rest on their laurels. We must turn our eyes to the Future.

On this, the advent of our "century in business," we thank you, our friends, for your ever loyal support and pledge that we of the Present "Hubbard" generation will keep faith with our predecessors of the past 100 years.

May our wishes for your Peace and Happiness bear fruit in 1943. Sincerely and Gratefully,

HUBBARD & COMPANY

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Crapo
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- A new and comprehensive manual, filled with engineering data and up-to-the-minute information about *Crapo* Steel Conductors, is just off the press.
- Its contents include electrical characteristics and performances of this high-tensile, low-resistance ferrous conductor, sag and tension tables and charts based on the new Fifth Edition of the National Electric Safety Code, recommended construction practices, results of outdoor vibration and fatigue tests never before published, and other valuable and timely information.
- Transmission and Distribution Engineers will find within its pages the solution to many of their present perplexing conductor problems. Write today for your copy of this new *Crapo* Steel Conductor Manual!

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Graybar Electric Company, Inc., Distributors

Crapo HTC-130 STEEL CONDUCTORS

TECHNICAL LITERATURE

STEEL PIPING MATERIALS—ASTM specifications, including emergency alternate provisions, covering steel pipe, tubes, castings, forgings and fittings, nuts and bolting material, also the standard austenite grain size chart (E-19), are compiled in one volume. Copies of the 256-page publication may be obtained from American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa.; price $1.75 per copy.

DIE CASTING—Principles of die casting machines, elements of die construction, alloys used, finishes, design and applications of die casting, are some of the subjects covered in "Die Casting for Engineers." The book is available from the New Jersey Zinc Co., 160 Front St., New York, N. Y.; price $1 per copy.

REFRIGERATION — Proper refrigeration, effect of refrigeration on bacteria and vitamins, quick-frozen foods, care and use of your refrigerator, and hints on buying food and food storage are discussed in a 16-page handbook "Electric Refrigeration and Wartime Health." File copy of the publication, third in a series of educational booklets on wartime use of home appliances, or quantities at 5 cents a copy, may be obtained from Westinghouse Home Economics Institute, Mansfield, Ohio.

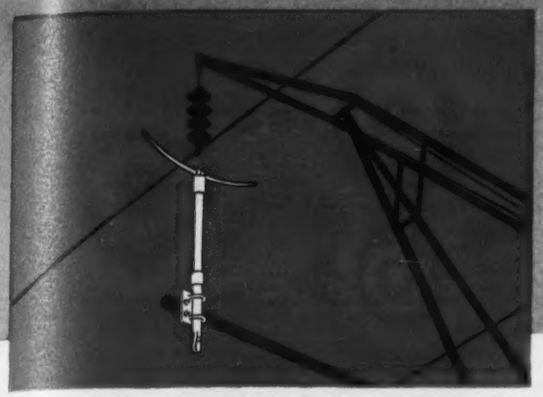
WROUGHT IRON—Booklet "Wrought Iron For Underground Service " discusses factors effecting soil corrosion of underground piping, weighs theory against test results, and outlines installation histories of water wells and lines, electrical cable conduit, oil and gas well and lines. Copy of the technical bulletin may be obtained from engineering service department. A. M. Byers Co., Pittsburgh, Pa.

CALCULATOR—Designed for use with Luckiesh-Moss visibility meter, a 6½-in. diameter two-disk calculator has been developed for determination of relative visibility of any visual task when amounts of light on that task are changed. The Visibility Calculator has been developed at General Electric's Nela Park, Cleveland, Ohio.

RECTIFIERS — Operating characteristics, charts, connection diagrams, answers to questions which come up in actual practice, and construction of 6-and 12-volt copper oxide rectifiers are given in Bulletin ER-103, "Rectifiers for Electroplating, Anodizing, and Electrotyping," obtainable from Hanson-Van Winkle-Manning Co., Matawan, N. J.

BATTERIES—Valuable hints on the care of storage batteries, whether in industrial use or in automotive service, are given in the industrial edition of Exide News, under the heading of "The Great Devourer." Copies of the publication may be obtained from Electric Storage Battery Co., 19th St. and Allegheny Ave., Philadelphia, Pa.

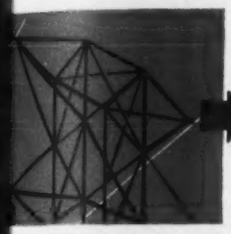
WELDING—Eutectic fusion explained, physical properties of Castolin Eutectic alloys, details of welding process, how to correct your welding faults, what metals can be welded, and where the process may be used, are subjects covered in the technical data book "Castlin Eutectic Low Temperature Welding Process." Copy of the book may be obtained from Eutectic Welding Alloys, Inc., 40 Worth St., New York, N. Y.



"De-ion" Tubes

PREVENT LIGHTNING-STOPPAGE OF WARTIME PRODUCTION

Lightning protection of Central Station service and uipment is even more important in wartime than peace. Lightning must not be allowed to cause a ppage of war production. And since Transmission nes are the "arteries" that bring the "lifeblood" to rtime production, they deserve unusual attention.



Lightning-Proofing of Transmission Lines in the conventional way would require ground wires, at least one extra wire (two for the best protection in many locations), above the current-rrying conductors. This is costly in peacetime, d the large amount of copper required makes it rohibitive today.

"De-ion" tubes save

85%

critical materials

Fortunately, however, the same protection can be obtained by installing "De-ion" Protector Tubes on *old* or *new* lines. This will save up to 85% of the Critical Material required.

R EXAMPLE: One mile of ½" ground wire on a 115-kv requires 3500 pounds of copper, in addition to the extra el required for a stronger tower.

To obtain the same protection with "De-ion" Tubes, only *590 unds of metal* are required. None of this is copper.

100,000

installed

Proof that "De-ion" Tubes are the answer to Wartime Protection of Transmission Lines are the 100,000 Tubes stalled since 1934 on Lines throughout the country om 13.8 to 220-kv.

Lightning outages reduced

95.3%

FOR EXAMPLE:

One large operating company built 13.8 and 26-kv lines with tubes placed in every combination, from every pole to every sixth pole. Results were:

SPACING OF TUBES	OUTAGES PER 100 MILES PER YEAR	
	BEFORE "De-ion" TUBES	AFTER "De-ion" TUBES
1 POLE IN 2	42	2
1 POLE IN 3	42	2
1 POLE IN 4	47	6.9
1 POLE IN 6	22.8	13.7

FOR EXAMPLE:

Another Utility with no tubes or ground wires, on a 26-kv line, having 10-foot crossarms 4 feet below the tops of the towers had an average of *10 fuses blown per year for 4 years.* "De-ion" Tubes placed on 10 of the towers reduced blown fuses to an average of *3 per year for the last 3 years* . . . a 70% improvement. Still better protection will be obtained by the installation of more tubes.

According to Service Records, "De-ion" Protector Tubes, properly applied, will practically Lightning-Proof any Transmission Line . . . old or new. In addition, they will:

- Save up to 85% of the Critical Material required by older methods.
- Reduce the amount of steel required for new towers or for strengthening old ones.
- Decrease the quantity of insulation needed to withstand switching surges.

For Technical Details, ask your Westinghouse Representative or write Westinghouse Electric & Manufacturing Company, Department 7-N, East Pittsburgh, Pennsylvania. J-60519

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"DE-ION" PROTECTOR TUBES

STOP SEARCHING FOR ELECTRICAL

CALL... "Insulation Headquarters"

MITCHELL-RAND
for
53 YEARS
THE ELECTRICAL
INSULATION
HEADQUARTERS

Manufacturers of electronic devices, radio, communication, electrical, aviation and all other industrials, having a need for electrical insulation will save valuable time and obtain helpful guidance by consulting Mitchell-Rand on matters pertaining to electrical insulation materials. Mitchell-Rand with its 53 years of specialized experience in the development of electrical insulation and with its complete manufacturing and warehouse facilities are able to give prompt service and quick deliveries.

THE M-R WALL SHEET
TABLE OF ALLOWABLE CARRYING CAPACITIES OF CONDUCTORS
CONDENSED TABLES OF NATURAL VALUES OF TRIGONOMETRIC FUNCTIONS OF IMPORTANT ANGLES
COMPARISON OF THERMOMETRICAL SCALES

The M-R Wall Chart, measuring 22x34 contains quick easy to read reference tables of electrical symbols, allowable carrying capacities of conductors, dielectric averages and thicknesses of insulating materials, mathematical tables, tap drill sizes, standards of varnished tubing sizes, etc.

The M-R Guide Book, 44 pages, pocket size containing complete data, specifications and prices of all M-R Products.

The Laboratory sample card of Tubing or Sleeving; samples ranging from size 20 to fit over B&S wire #20 (.032") to size 0 to fit over B&S wire #0 (.325")

Mitchell-Rand Offers Free for Your Asking Three Helpful Laboratory Aids

These are FREE FOR YOUR ASKING . . .
Write today on your letterhead

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MITCHELL-RAND INSULATION COMPANY, INC.
51-B MURRAY STREET COrtlandt 7-9264 **NEW YORK, N. Y.**

A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds

Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

NEWS ABOUT PEOPLE

Scranton Electric Names Nagle General Manager

C. Floyd Nagle has been appointed general manager of the Scranton Electric Co., Scranton, Pa., to succeed the late Duncan T. Campbell.

Mr. Nagle spent two years with the

Westinghouse Electric & Manufacturing Co. at East Pittsburg and one year as engineer with the Pennsylvania Coal Co. before entering the utility field. It was in 1907 that he became identified with the Citizens Electric Illuminating Co., Pittston, Pa., as operating manager, remaining in that position until 1917. He became associated with the Scranton Electric Co. through merger of Citizens Electric, in 1920 becoming superintendent of distribution and transmission. Six years later he was made general superintendent.

Mr. Nagle was born in Mt. Corry, Ohio, and received his engineering education at Lafayette College.

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▶ MAURICE R. ELY, office manager of the Electric Association, Chicago, has resigned to join Sylvania Electric Products, Inc., as lighting sales engineer. Mr. Ely has been with the Electric Association since shortly after its inception in 1925. In addition to his duties as office manager he has been secretary-treasurer of the Electrical Maintenance Engineers and the West Suburban Electric League.

•

Westinghouse Appoints New Lamp Officials

Bernard H. Sullivan, manager of sales for the Westinghouse lamp division, Bloomfield, N. J., has been assigned responsibility for all commercial activities involving lamps and special products and Ralph C. Stuart has been appointed manager of manufacturing and engineering for the division. Announcement of the new appointments follows the recent death of David S. Youngholm, vice-president in charge of the lamp division.

Mr. Sullivan will continue to have charge of the illuminating engineering and commercial engineering departments, as well as sales, advertising and division district offices. In addition he will supervise activities of the special products commercial department and will report to B. W. Clark, vice-president at headquarters in Pittsburgh.

B. H. Sullivan

R. C. Stuart

Under the new plan Mr. Stuart, who has been manager of manufacturing, also will head engineering activities and will report to George H. Bucher, president. Both officials will continue to make their headquarters in Bloomfield, N. J.

Mr. Sullivan is an executive of more than 25 years' experience in the lighting industry and has been associated with Westinghouse since 1922. Mr. Stuart, who was manager of the West Plant of the Canadian Westinghouse Co. at Hamilton, Ont., from 1930 until January of last year, became manager of manufacturing at the Lamp Division last July, after six months as manager of parts manufacturing.

•

▶ HAROLD J. MERILEES, head of the dealer relations department of the merchandising division of the B. C. Electric Railway Co., Vancouver, B. C., has been granted leave of absence for the duration and has been appointed organizer for the Vancouver division of the National War Finance Committee.

SEED MONEY *will*

(This advertisement appeared in a group of newspapers on Tuesday, January 26, 1943)

WE DOUBT if a guy in a tank has much time to worry about how he is going to make a living when the war is over. That's the duty of the folks at home.

Thoughtful men in political life are beginning to talk about the need for assuring jobs not only for returning fighting men, but also for the millions who have found work in war production.

Vice-President Wallace has summed up the yearnings which all of us feel for a better world to follow this war in his phrase, "The Century of the Common Man."

► We think he means that if all of us can find fruitful work to do, we will enter upon a new era of happiness that grows not only from material well-being, but from a sense of personal accomplishment.

No one could ask for a better grasp of the objectives that stir the souls of men than has been shown by the leaders of both of our political parties.

The only difference of opinion that could possibly exist on such noble objectives is in the method by which the common man can be given his century.

► Most business men know that jobs and good wages make good business.

Most wage earners know that business must be healthy if it is to support good pay and give a job to everybody who wants to work.

Where we run into trouble is that we don't hold on to these simple facts when we make our laws.

If a law helps business, it helps the worker.

If a law SAYS it helps the worker, but really *hurts* business, it can never have the effect for which it was intended.

That isn't the fault of business. It's just another evidence of the supremacy of common sense.

► *Here's a simple formula for making jobs after the war:*

1. Remember that the United States invented machines and manufacturing methods that have given the highest standard of living in the world.

2. Good wages and good living result from
   a. More output per worker
   b. Less cost per unit produced
   c. Lower prices to consumers

3. Therefore, the only way to live better is through constant improvement in our machines and methods.

4. However, it is a natural political tendency to try to legislate good living. This cannot be done, except as legislation promotes sound industrial progress. *Industrial progress, not legislation, is the source of all good living.*

make jobs for soldiers

5. But good living depends upon constant development and use of new and better machines and methods. These things cost money.

6. Money for new machines and better methods must come out of the profits of business. (This reinvested profit of business is called SEED MONEY.)

7. To prevent a crop of war millionaires, Congress passed a law which not only accomplishes that objective, but also takes away SEED MONEY which business will need after the war.

8. If you want to see that every ambitious man has a chance to work after the war, write your Congressman and remind him that private profit and the SEED MONEY of business are two entirely different things. Business should be allowed to accumulate more SEED MONEY, for making post-war jobs. Lawmakers help make good living for you when they make laws that make good business. At the same time they create the best insurance for the Century of the Common Man.

"What's Good for Business is Good for Americans"

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production-men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

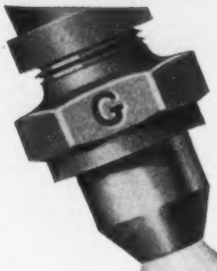
Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL

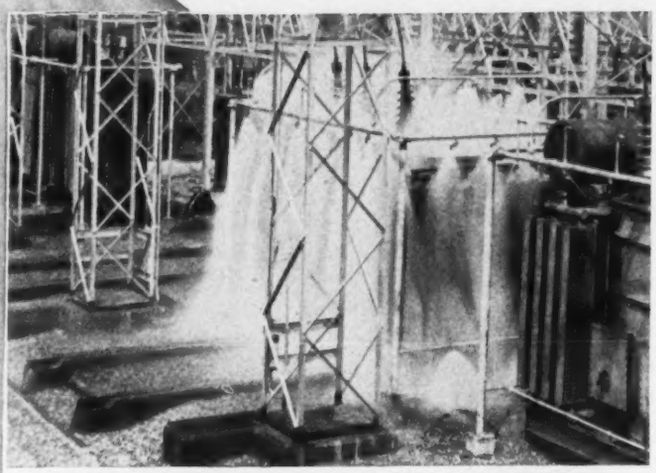
PUBLISHING COMPANY, INC. . . . 330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Affiliated with Business Publishers International Corporation, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.



Simpler, Surer ANTI OIL-FIRE Equipment



APPLIES WATER IN NON-CONDUCTING SPRAY!

The unique Mulsifyre Oil-Fire Protection System works on the positive principle of emulsifying the surface of blazing oil with water spray to make it non-flammable. It is successfully employed today by leading utilities the country over.

Grinnell Mulsifyre Systems are fixed equipment, operated either manually or automatically. High-pressure water admitted to the system creates high-velocity spray so fine that it is electrically safe... so fast it stops fire in 2 to 5 seconds!

WRITE for authoritative Data Book on Mulsifyre Systems by Underwriters' Laboratories. Grinnell Co., Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of the U. S. and Canada.

GRINNELL
MULSIFYRE
Fire Protection Systems

Mr. Merilees has been connected w the B. C. Electric in dealer relat and sales promotion work for the p twelve years. Recently he was a pointed supervisor of accident prev tion by the company.

► GEORGE W. ALLISON, for many ye connected with the Edison Electric stitute, together with various jo E.E.I. and N.E.M.A. industry progra has become associated with Kenneth McIntyre, consultant in industrial re tions, with headquarters at 2 Rec Street, New York City. Dr. Allison w be closely identified with supervis training and development programs a number of operating utility co panies.

► FLORENT E. VERDIN, for many ye personnel manager of the Central N York Power Corp. of the Niagara-Hu son System, has become associated wi Kenneth A. McIntyre, consultant in i dustrial relations, with headquarters New York City.

► PAUL WOOTON, chief of the Washi ton Bureau of the McGraw-Hill Pub cations, has been elected president the White House Correspondents As ciation.

► W. GIBSON CAREY, JR., and HERBE C. DAVIDSON have been elected truste of Consolidated Edison Co. of Ne York, Inc. Mr. Carey is president the Yale & Towne Manufacturing C and Mr. Davidson is a vice-president Consolidated Edison.

► ROBERT M. KEENEY, chief of the ste division nickel section of the WPB Washington, D. C., and formerly indu trial manager of the Connecticut Lig & Power Co., Waterbury, Conn., h been appointed deputy director of t general industrial equipment divisio WPB.

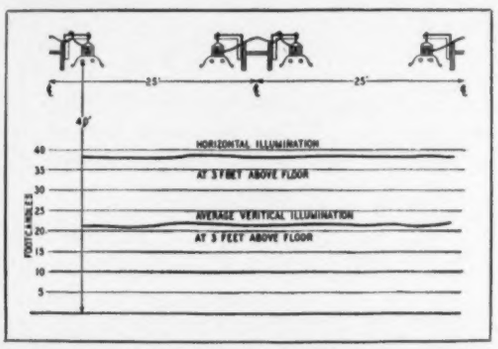
► GEORGE N. BEAMER, formerly Indian attorney-general, has been appointed member and chairman of the Indian Public Service Commission by Go Henry F. Schricker to succeed Fred Eichhorn of Gary, who resigned to r enter law practice in his home cit Mr. Beamer, who completed a two-ye appointive term as attorney-general r cently, will serve the remainder of t term of Mr. Eichhorn, which expir July 1, 1945.

► HARRY E. NEWELL, assistant chi engineer of the National Board of Fi Underwriters, New York, will b awarded the James Turner Morehea Medal for 1941 for his "leadership developing standards for installatio and operation of acetylene equipme and systems." The Morehead Medal given annually by the Internation Acetylene Association in honor of t late James Turner Morehead, w sponsored the experiments which l

How Floors That Reflect Light
PROMOTE MORE COMFORTABLE SEEING

Light-reflecting floors made with Atlas White portland cement reduce contrast and shadows in Boeing, Consolidated, Douglas and North American plants. In the Consolidated plant at Fort Worth, shown here, tests by General Electric show that the white-cement floor, compared with the gray-cement floor in the same plant, reflects 61% more light to underside of wings and increases light on vertical surfaces 20%.

A light-colored concrete floor made with *white* portland cement has a higher reflection factor than a floor made with gray portland cement or other darker materials. Thus a white-cement floor reduces the contrast between the seeing task and the floor and thereby enables industry to use light more efficiently, more effectively and more comfortably.



In same plant as shown in photograph, average vertical illumination throughout white floor area is more than half the horizontal illumination. (Diagram from *Electrical World*, July 25, 1942).

MANY factory materials—aluminum, steel, textiles, plastics—are light in color and have relatively high reflection factors. But most factory floors are dark and have low reflection factors. This wide variation in brightness between the work and the floor causes eyestrain and eye fatigue.

Light-colored concrete floors made with Atlas White portland cement help correct this condition. They reduce the contrast in brightness between the visual task and the floor. This makes the eye more sensitive—greatly increases visual acuity—makes seeing easier, quicker, more comfortable.

White-cement floors encourage cleanliness and are easy to maintain. The photograph shows how they reduce shadows and greatly increase illumination on the underside and on vertical faces of work. The diagram shows the high level of vertical illumination—more than half the horizontal illumination.

Today, Universal Atlas Cement Company joins you in intelligently promoting "Better Light—Better Sight." Our salesmen and our advertising are calling upon your customers—architects, engineers, contractors, factory superintendents, executives. We are reinforcing your story of better light. Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York.

• • •

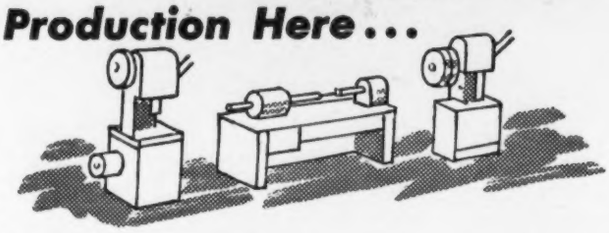
OFFICES: *New York, Chicago, Philadelphia, Boston, Albany, Pittsburgh, Cleveland, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Birmingham, Waco.*

E.W.-F11

ATLAS WHITE CEMENT
FOR LIGHT-REFLECTING FLOORS

FIRE HERE

CAN KILL *Production Here...*



and MEN Here...

● Protection of electrical facilities from fire damage has become a military necessity. It calls for the same sort of foresight as protection of an ammunition dump near the front—industrial generalship!

Cardox becomes the logical means, because it uses low temperature liquid CO_2—"knocks out" fire *immediately*—leaves no damage by the extinguishing medium—limits damage to actual flame areas. Cardox Systems are *engineered* to fire conditions for *engineered performance*—cover large areas—offer high reserve capacity.

Good executive judgment will recognize the urgent need for action—when serious hazards are getting by, from day to day, *without* complete coverage. Take the first step now to "knock out" any possible fire on your property by a timed, mass discharge of Cardox. Just write for Bulletin 572.

Stop Fire with

CARDOX CORPORATION

Bell Building, Chicago, Illinois

District Offices in New York • Detroit • Pittsburgh • Cleveland Kansas City • Atlanta • San Francisco • Los Angeles

CARDOX

NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

to the discovery in 1892 of the mode electric-furnace method of producin calcium carbide, from which the acety lene industry has sprung. Mr. Newe has been affiliated with the Nation Board of Fire Underwriters since 190 most of this time working with th committee on fire prevention and engi neering standards. In addition to bein an honorary member of the Interna tional Acetylene Association, he is member of the National Fire Protectio Association, the American Society o Civil Engineers and is active in the a fairs of the American Standards Ass ciation.

► CHARLES F. BILLINGS, for 19 year assistant superintendent of the Wes inghouse lamp division plant at Tren ton, N. J., has been appointed indus trial relations manager of the divisio with headquarters in Bloomfield, N. J Mr. Billings succeeds Walter F. Olive who has been granted a leave of ab sence to become director of the civilia personnel branch, U. S. Army ordnanc department in New York.

► T. O. EATON has been appointed as sistant manager of sales, power trans former section, at General Electri Co.'s Pittsfield Works. Mr. Eaton en tered the company's test course at th Schenectady Works in 1926, and fou years later he was transferred to Pitt burgh as switchgear specialist. He wa a member of the industrial sales de partment at Pittsburgh from 1933 t 1938, when he was transferred to Phi adelphia as switchgear specialist.

► WILLIAM G. MERVINE, who has bee connected with the engineering staff o the American Gas & Electric Co. in Ne York since 1936, has resigned. Prior t his connection with American Gas M Mervine was chief mechanical enginee for the Federal Power Commission i Washington for about two years. Earlie in his career he had been with U.G. interests in Philadelphia for man years.

► CHARLES H. EISENHARDT has been ap pointed assistant manager of the ele trical, wire rope and construction mat rials sales division of the America Steel & Wire Co., U. S. Steel subsidiar succeeding R. L. Rhodes, resigned. M Eisenhardt has been associated with th wire company since 1925.

► JAMES W. CARPENTER, vice-presiden of the Long Island Lighting Co., w re-elected president of the Electric and Gas Association of New York the recent annual meeting. Other of cers elected were: Vice-presidents, S. O'Brien, president S. J. O'Brien Sal Corp.; T. F. Barton, vice-presiden General Electric Co.; T. H. Josep president E-J Electric Installation C and Norman L. Myers, eastern ma

ger, electric appliance division, Westghouse Electric & Manufacturing Co.; easurer, H. C. Calahan, district manger, General Electric Supply Corp.; ecretary, James A. Sackett, sales manger Kings County Lighting Co., and ssistant secretary, C. A. Norton, sales anager, Pierce Laboratory, Inc.

OBITUARY

Thomas W. Drought

Thomas W. Drought, vice-president d a director of the New York Power Light Corp., died on January 27 at s home in Albany, after several weeks' ness. He was 53 years old.

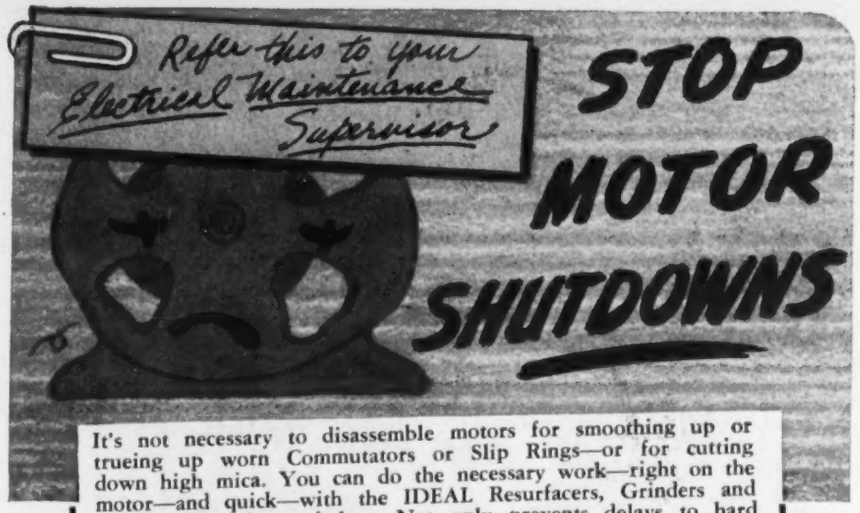
Mr. Drought's connection with the ility industry dates back to 1908 hen he entered the employ of the roadalbin Electric Light & Power Co. or several years prior to 1926, when e Broadalbin company was acquired the Fulton County Gas & Electric o., Mr. Drought had been its vicesident and general manager. He ontinued at Broadalbin as district perintendent until the following year, hen he was made commercial manager the Mohawk division of the newly rganized New York Power & Light orp., with an office at Gloversville. In 929 he was transferred to the general ffices of the company at Albany as rate ngineer. Subsequent assignments fol-wed at Schenectady and Glens Falls. was in 1936 that he was elected a ice-president.

•

JOHN W. CORNING, 70, former electrical engineer of the Boston Elevated ailway Co., died at Portland, Me., on ecember 30. He was a native of Baltiore, Md., and a graduate of Johns opkins University. He entered the ompany's service in 1893 and served ith distinction as its chief electrical ngineer from 1905 to 1915, when he etired from professional practice, reding at Yarmouth, Me.

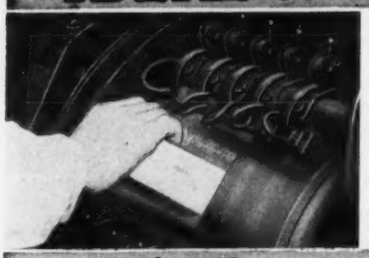
CHARLES D. ASHCROFT, manager of e St. Louis department of the Hartrd Steam Boiler Inspection and Inurance Co., died on January 12 at St. ouis, Mo. He was a native of Springeld, Mass., and after joining the comany at Hartford in 1907 became a pecial agent at Louisville, Ky. In 1911 e was appointed manager of the Pittsurg department, and went to St. Louis 1913, to assume his late position.

GEORGE B. WHEELER, chairman of the oard of directors of the Union Naonal Bank of Eau Claire, Wis., and me years ago prominently identified ith the utility industry in that state, ed at his home in that city on Janury 22. He was 89 years of age. Mr.



It's not necessary to disassemble motors for smoothing up or trueing up worn Commutators or Slip Rings—or for cutting down high mica. You can do the necessary work—right on the motor—and quick—with the IDEAL Resurfacers, Grinders and Undercutters shown below. Not only prevents delays to hard working production lines, now, when production is so vital, but cuts motor maintenance cost at any time.

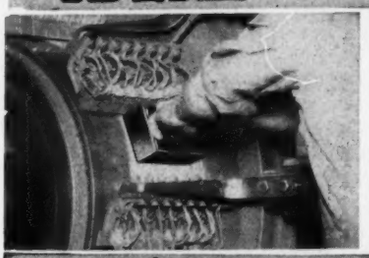
IDEAL Commutator Cleaning Stone



Quickly Removes Excess Film

Inexpensive—you can't afford to be without it! A few seconds application periodically cleans away excessive deposits of dirt or brush material caused by heavy and continuous power loads. Doesn't cut commutator; doesn't clog. Helps to seat brushes as it cleans, increasing brush life. 5 sizes.

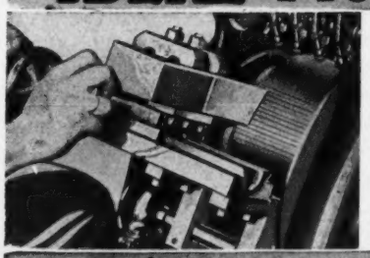
IDEAL Resurfacers



Keep Motors On The Job, WITHOUT DISMANTLING

Quick, easy way to periodically smooth up Commutator and Slip Rings. Refinish to a smooth, highly polished surface in own bearings. No dismantling; no production delays. Using IDEAL Resurfacers periodically to keep Commutators and Slip Rings like new—eliminate production delays! Over 175 Styles and sizes.

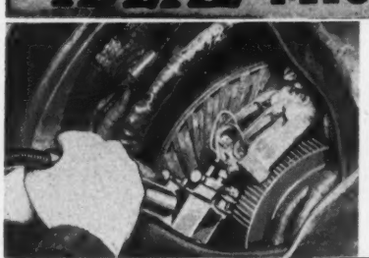
IDEAL Precision Grinders



True Up Commutators and Slip Rings In Their Own Bearings

If your Commutators and Slip Rings are badly grooved, scored, or out of round, this is the easy way to restore them to original efficiency, WITHOUT DISMANTLING. Mounts directly on the brush arms or frame; grinding is done at normal operating speeds under the machine's own power. 3 models.

IDEAL Mica Undercutters



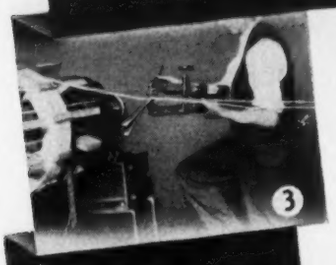
For Undercutting High Mica

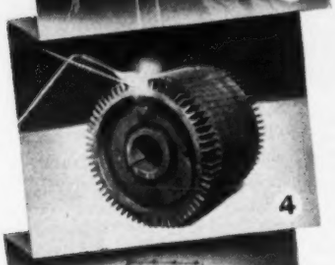
IDEAL Undercutters cut the hardest mica. Three Models: (1.) "Direct Drive", small, handy unit that undercuts without removing a single brush; (2.) "Universal", smallest, most powerful undercutter on the market; (3.) "Shop Model", for large commutators.

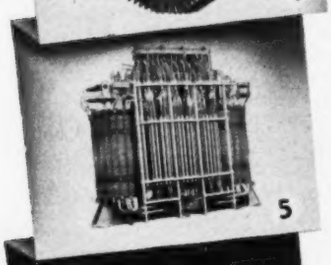
Write for Literature on Complete Motor Maintenance Line.

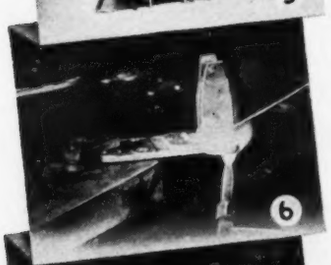
IDEAL COMMUTATOR DRESSER CO.
1021 Park Avenue Sycamore, Ill.
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd. Montreal, Quebec

SIL-FOS AND EASY-FLO LOW-TEMPERATURE SILVER BRAZING ALLOYS









ARE SERVING ON THE HOME FRONT ON THE WAR FRONTS *in millions of Electrical Connections*

Of the vast amount of metal joining which the low-temperature silver brazing alloys, Sil-Fos and Easy-Flo are doing, none is more vital to the war effort or more extensive than the making of **electrical connections.**

For electrical equipment plays such an important part, both on the home front and on the fighting fronts. **And none of this equipment is any better or more reliable than its electrical connections.**

Sil-Fos and Easy-Flo are widely used for making electrical connections because they satisfy every requirement of this type of work. They not only make joints **high in electrical conductivity with the strength of solid metal and the ductility to withstand severe vibration, shock and temperature changes, but they also make them fast and at surprisingly low cost.** These facts have been established by makers of electrical equipment through research and years of successful use.

KEY TO ILLUSTRATIONS

1. Silver contacts brazed to parts of circuit breakers.
2. Joining windings and leads on magnetic electrical coils.
3. Brazing taps and connections on a transformer winding.
4. Joining rotor bars to end rings of induction motors.
5. There are over 400 Sil-Fos brazed joints on this transformer.
6. Making switch jaw assemblies.
7. Joining bus bars in a power plant.

BULLETIN NO. 12 GIVES YOU THE FACTS

Tells you all about Sil-Fos and Easy-Flo and the reasons for their speed, reliability and economy—shows you how easy it is to start using them—gives practical information about joint designing, heating methods, fast production procedures. A copy will be mailed to you on request. Write for it today.

ARMY E NAVY

HANDY & HARMAN 82 FULTON ST., NEW YORK

Agents in Principal Cities. In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

Wheeler was born in Kennebunk, Me., and was graduated from Bowdoin College in 1874. In 1891 he became general manager of the Eau Claire Street Railway, Light & Power Co. and its successor, the Chippewa Valley Railway, Light & Power, until 1914, when the system was sold to the Wisconsin-Minnesota Light & Power Co. The same year Mr. Wheeler became president of the Union National Bank, serving in that capacity until 1935, when he resigned because of poor health. He was a past-president of the Wisconsin Electrical Association.

▶ WESLEY J. NIEBERGALL, formerly district superintendent of the Illinois Northern Utilities Co. at Freeport, Ill., died on January 22, at the age of 37. Mr. Niebergall had previously been connected with the same utility at Dixon and earlier in his career in the utility industry with the Western United Gas & Electric Co. at Aurora.

▶ WILLIAM H. CHAMBERLAIN, who retired as Perth Amboy district superintendent, electric distribution department of the Public Service Electric & Gas Co., Newark, N. J., last July, died on January 22, of a heart ailment, at his home in Woodbridge, N. J. He was 70 years of age. Mr. Chamberlain started in the utility industry with the Suburban Electric Co. at Elizabeth in 1895. Later he became identified with the Elizabeth-Plainfield and Central Jersey Street Railway Co. and subsequently was transferred to the Somerset, Union & Middlesex Lighting Co. When Public Service was formed Mr. Chamberlain became general foreman of the central division, remaining in that position until 1910, when he was transferred to the Perth Amboy district as district superintendent.

▶ MILTON I. MORGAN, chief marine electrical engineer for Dravo Corporation, Pittsburgh, Pa., died on January 6, of injuries received in a fall. He was 34 years of age. He gained his early electrical experience at Illinois Central Railroad and was employed with the Memphis Power & Light Co. from 1927 to 1934. Then he transferred to the Tennessee Valley Authority, where he undertook engineering duties in the development of final drawings for Norris and Wheeler power houses and switchyards. Later he became identified with the development of the Guntersville, Chickamauga, Watts Bar plants and participated in the design engineering for the Fort Loudoun and the Cherokee hydro-electric projects. In 1940 he resigned his position with TVA to join the Aluminum Co. of America, where he was engaged in the design and construction of the Glenville and Nantahala hydro-electric developments. His affiliation with the Dravo Corporation in the

pacity of chief marine electrical engi- er followed. In addition to his rine duties, he assisted in the devel- ment of extensive underground elec- cal distribution network systems at e corporation's shipyards.

EDWIN A. OLSEN, sales engineer and orthwest representative for the Rail- y & Industrial Engineering Co., died ddenly in Seattle on January 24, in s forty-ninth year. Born in Everett, Vash., Mr. Olsen was graduated from e University of Washington in elec- cal engineering. For many years he as active in engineering circles in the orthwest.

CHARLES B. LORD, 60, for the past six ears an illuminating engineer with the arragansett Electric Co., Providence, I., died at Edgewood, R. I., on De- ember 30. He was a native of Paw- cket, R. I., and was formerly con- ected with the Union Electric Supply o., Providence.

P. N. SANDSTROM, 39, supervising lanning engineer in Commonwealth dison Co.'s system development de- artment, died January 14 in Chicago, fter a brief attack of pneumonia. Mr. andstrom joined the Chicago company n 1924 as draftsman and rose rapidly hrough the positions of checking raftsman, supervising draftsman, as- istant engineer and planning engineer o the position held at the time of his eath—in charge of planning on the igh-tension system of the Edison com- pany. Mr. Sandstrom was born in weden and was educated at the Tech- ical College, Obebro, Sweden. He was member of the American Institute of lectrical Engineers and author of everal technical papers and articles on igh-tension operation.

GEORGE B. KARELITZ, professor of echanical engineering at Columbia niversity and noted authority on lubri- ation, died on January 19 in New ork, as the result of a heart attack. He was 47 years of age. Mr. Karelitz as born in Russia and was graduated rom the Imperial Polytechnic Institute t Petrograd in 1918. He was a con- ulting engineer for the Northwestern Waterways of Russia from 1918 to 921, when he went to China to work s a naval architect. He came to the nited States in 1923 and was em- loyed by the Westinghouse Electric Manufacturing Co. until 1930. He as appointed assistant professor of echanical engineering at Columbia in 930 and left the following year to be- ome manager of the marine depart- ent of the Westinghouse company at outh Philadelphia. He returned to olumbia University in 1933, but had emained a consulting engineer for Westinghouse since that time.

HERE IS "LONG LIFE"★ AGAIN!

NO STARTERS
NO HIGH VOLTAGE
with
3000-HOUR GUARANTEED LAMPS

That's ARTKRAFT HOT CATHODE Fluorescent Lighting

SIGNS* OF LONG LIFE

This registered Trademark of The Artkraft Sign Co., the world's largest manufacturer of all types of signs, (now engaged 100% in war work).

This strong institution is your permanent assurance of ready lamp replacements.

We wish to express our thanks to all those who responded to our first announcement, last month, of our new product. This response was very gratifying and we are doing our best to handle all correspondence promptly.

WHOLESALERS:
Write for our proposition.

FIXTURE MANUFACTURERS:
Write for details on constant voltage manufacturing license.

The STARTLING FACTS are these

- 3,000-HOUR LAMP GUARANTEE. Rated 5,000 to 6,000 Hours.
- NO STARTER SWITCHES. Artkraft resonant starting eliminates this trouble-maker.
- CONSTANT VOLTAGE POWER PACK. Gives efficient operation at 85 to 135 volts. Can also be used on 220— and 440-volt systems, single or three-phase. Cannot short circuit the line.
- 100% POWER FACTOR at rated voltage. 98% or over within 85 to 135-volt range.
- "EASY MOUNT" LUMINAIRE ALLOWS INSTANT REMOVAL WITHOUT TOOLS, FOR CLEANING NON-FERROUS REFLECTOR OR LAMPS.
- CONSTANT TEMPERATURE HOT CATHODES. Light at 40° below zero, operate efficiently at low temperatures.
- STROBOSCOPIC (FLICKERING) EFFECT REDUCED.
- MORE LIGHT FOR THE SAME CURRENT.
- FIELD TESTED UNDER ADVERSE CONDITIONS FOR OVER FIVE YEARS.
- MODERATE FIRST COST. RADICALLY REDUCED MAINTENANCE COST. Lamp replacements are less frequent, starter replacements eliminated, ballast replacements unknown, man-hours saved by making these replacements unnecessary.

Free! NEW ILLUSTRATED CIRCULAR USE THIS COUPON

Artkraft Sign Co.
1115 E. Kibby St., Lima, Ohio.

Please send without obligation your new profusely illustrated circular F102 ☐ Have qualified Artkraft Fluorescent Lighting Engineer call ☐

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Firm Name.....

Address .....

ARTKRAFT Hot Cathode FLUORESCENT LIGHTING
Division of The Artkraft Sign Company.
General Offices: 1115 E. Kibby St. Lima, Ohio, U. S. A.

LONG LIFE DEPENDABILITY

MANUFACTURING-MARKETS

G.E. Launches 1943 Servicing Program

General Electric Co.'s appliance and merchandise department and its distributors has started the year 1943 with a concentrated coast-to-coast series of training meetings devoted principally to the servicing of electric ranges and water heaters. Other products have been covered in previous meetings.

W. C. Noll, manager of the G.E. product service division, Bridgeport, Conn., announces that the range meetings will combine all of the features which servicing dealers found most desirable during the hundreds of training meetings held during similar series in 1942. The forthcoming series of meetings will cover, in addition to ranges and water heaters, a digest of repair information on small appliances, a review of refrigerator and laundry equipment, and round table discussion between servicing dealers and G.E. distributors and headquarters field men.

One of the highlights of the range training meetings will be the showing of a new full color movie entitled "Don't Blame It on the Oven." Another feature will be a sound slide film entitled "Heating Unit Service," which gives visually the answers to surface unit and thrift cooker problems and a third will be the showing of a series of slides entitled "Heating Device Repairs."

•

Radio Corp. Unit Merges with Parent Company

Announcement has been made of the merger of the RCA Manufacturing Co., Inc., into its parent corporation, Radio Corporation of America. Under this merger Radio Corp. of America succeeds to all the rights and assumes all the obligations of RCA Manufacturing Co., Inc.

The merger is being effected for purposes of efficiency in corporate organization and, according to the official announcement, it simply means that, instead of continuing as a wholly owned subsidiary of Radio Corp. of America, the organization of RCA Manufacturing Co. will continue as the manufacturing division of Radio Corp. of America.

•

Copperweld Consolidates Southern Districts

Copperweld Steel Co. has announced the consolidation of its former southwestern and southeastern districts into a new southern district under the supervision of E. B. Patterson, southern sales manager, with offices at 1403 Sterick Building, Memphis, Tenn. The new district comprises the states of New Mexico, Texas, Oklahoma, Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Georgia, North Carolina, South Carolina and Florida.

Southern district branch offices will be maintained at 508 Southland Life Building Annex, Dallas, Tex., and the Rhodes-Haverty Building, Atlanta, Ga.

•

Manufacturers Issue Earnings Reports

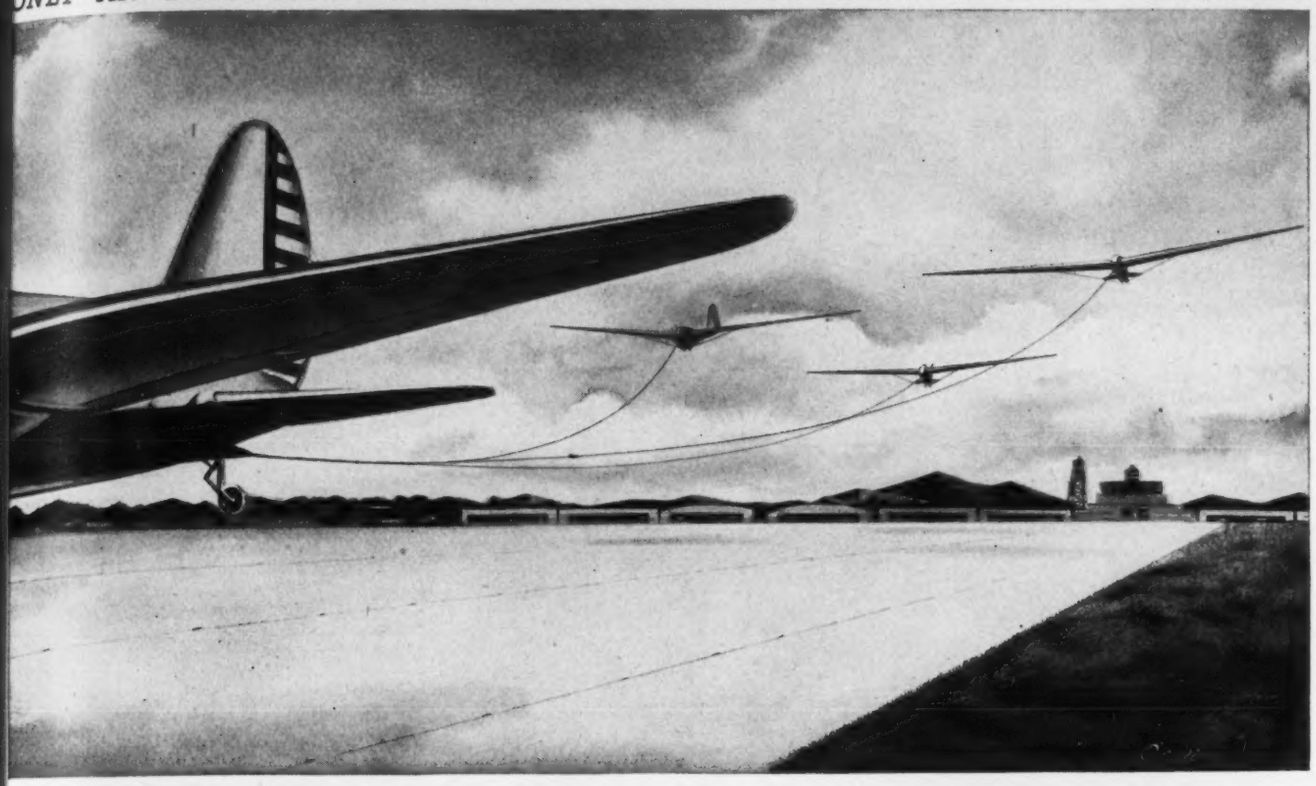
Rome Cable Corp. reports for the quarter to December 31 net profit amounting to $97,546, equal to 51 cents a share, compared with $150,059, or 79 cents a share, in the same period in 1941. Nine months to December 31, net profit, $215,064, equal to $1.12 a share, compared with $392,411 or $2.07 a share for the nine months to December 31, 1941.

Among the other companies reporting are the following:

WESTON ELECTRICAL INSTRUMENT — Including subsidiary, nine months ended September 30, 1942, net profit of $501,951 after charges and provision of $4,510,000

HUBBARD & COMPANY CITED—For excellence in production Hubbard & Co., Emeryville, Calif., was recently awarded the Army-Navy "E." Principals participating in the ceremony included (left to right) W. W. Glosser, vice-president, Pacific Coast division, Hubbard; Captain Stanley M. Haight, U.S.N., Commanding Officer, Naval Net Depot, Tiburon, Calif., and R. E. Fisher, vice-president Pacific Gas & Electric Co.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION



WESCO helped gliders fly 5 weeks earlier

Delivered Materials Complete in 19 Days; Huge Plant Met Government Deadline

In the granary of America a glider plant was ordered built; time limit for completion 30 days. On the 20th of the month the nearest Wesco House received the large order for panelboards, transformers, fluorescent lighting, power cable and potheads. The job was awarded because of Wesco's reputation for fast delivery and follow-through service.

Wesco placed all orders the same day and suppliers the country over sprang into action. In less than a week trucks rolled up and began unloading at the site. In 19 days every item ordered from Wesco was on the job as compared with 7 weeks best possible delivery from manufacturers. The plant was completed and in production on the 30th day.

This Wesco performance, and scores like it, don't just happen. They are the result of years of training, experience and individual ability. Wesco service has enlisted "for the duration". After Victory it will again speed the development of business.

WESCO SPEEDS PRODUCTION

* A Marine air base needed delivery of hundreds of electrical items next morning. Five Wesco Houses pooled stocks and met the deadline.
* Lack of a critical product threatened to tie-up a war chemical plant. The manufacturer promised delivery in 60 days. Wesco delivered in 24 hrs.!

WESCO SERVES BUSINESS

* By warehousing stocks in anticipation of customers' needs.
* By providing engineering service in making up lists of materials and in preparing bids on jobs.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.

Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

"Take care of those pliers, son"

THE old-timer who knows good tools passes on the word to the "grunt" just learning "Good tools deserve good care."

And today, when every tool that can be produced has a job to do licking the Axis, taking care of tools is an aid to winning the war as well as being good business.

Owners of genuine Klein equipment can rely on its high quality to assure maximum service. Proper care means longer life for tools which will be difficult, if not impossible, to replace during wartime.

ASK YOUR SUPPLIER. FOREIGN DISTRIBUTOR: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK

Since 1857

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

1200 BELMONT AVENUE, CHICAGO

for estimated refund to Government on war contracts, post-war adjustments and federal income and excess profits taxes, after deduction for post-war refund of 10 percent of excess profits taxes. This is equal to $3.12 a share on 160,583 shares of common stock, and compares with net profit of $713,584 or $4.44 a share in the first nine months of 1941, when $1,430,000 was set aside for federal taxes.

CARRIER CORP.—For fiscal year ended October 31 consolidated net income totaled $541,564 after depreciation, interest, amortization, provision of $1,395,000 for federal income, surtax and excess profits tax and tax contingencies. This is equal to $1.33 a share (par $1) on 405,676 shares of capital stock, and compares with a net profit of $515,949, or $1.31 a share on 392,156 capital shares, in the ten months ended October 31, 1941, after provision of $657,000 for federal income, surtax and excess profits taxes. The company's fiscal year was changed during 1941 to end October 31.

•

More War Plants Get Army-Navy Award

Among the plants recently selected to receive the Army-Navy production award are the following:

Corning Glass Works, Corning, N. Y.; Ford, Bacon & Davis, Inc., Arkansas Ordnance Plant, Jacksonville, Ark.; National Carbon Co., Inc., Krene division, Bennington, Vt.; Revere Copper & Brass, Inc., Michigan Division, Detroit; Sanderson & Porter, Elwood Ordnance Plant, Joliet, Ill.; Borg-Warner Corp., Long Manufacturing Division, Detroit, and Pump Engineering Service Corp. division, Cleveland.

The Navy E star burgee for "continued production excellence" has been awarded to the Worthington Pump & Machinery Corp., at Harrison, N. J. In recognition of "continued splendid achievement in outstanding production" American Steel & Wire Co., U. S. Steel subsidiary, has been granted a renewal of the Navy "E", Worcester plant.

•

Marks Fiftieth Birthday

The engineering organization of Chas. T. Main, Inc., Boston consultants, recently attained its golden anniversary. Established in 1893 as a partnership under the firm name of Dean & Main, the house became Chas. T. Main, Engineer, in 1907, and a corporation in 1926. Its practice has embraced many power, industrial and war production plants in this country and overseas, besides work of prime importance during the present war for the army and navy, shipbuilding and other establishments. Chas. T. Main, dean of Boston engineers, is chairman of the board; William F. Uhl, president and treasurer, and Ray A. Moncrieff, vice-president.

Field Reports on Business

Manufacturers are bidding on a wide range of electrical apparatus in government schedules, with heating elements and small switch and control lots taking a prominent part. Engineering construction, as forecast, has been drastically curtailed this year. Extensive building, however, for the housing of war workers in defense areas continues in large volume.

NEW YORK

Discussion is being resumed again in some circles that WPB may ease some of its stringent material and manufacturing restrictions to permit production of a limited number of "victory" models of certain electric appliances. With the Controlled Materials Plan becoming effective, the argument goes, the materials situation will be clarified sufficiently for WPB to divert some metals to civilian consumers durable goods. The Army and the Navy, however, would probably be the first to benefit from such a program as they are purchasing some items for military use at present and the demand is greater than the supply. The 40 percent cut in fuel for commercial laundries, too, is expected to result in restricted service and revive the demand for a "victory" model washing machine. The present stocks of mechanical refrigerators are under heavy purchase restrictions and manufacturers are complaining to Washington that a limited number of ice-boxes are being fabricated while no mechanical models are permitted to be made.

Department store sales for the week ended January 23 were up 2 percent over the corresponding week a year ago, according to the Federal Reserve Board. Boston and New York, however, were off 5 percent and Philadelphia remained static.

Engineering construction for the week ended January 28 totaled $41,855,000, as compared to $221,694,000 for the corresponding week a year ago, according to the *Engineering News-Record*, a drop of 81 percent, reflecting the drastically curtailed private and public construction programs forecast for the present year.

NEW ENGLAND

An order for 2,500 fluorescent fixtures received by Sylvania Electric Products, Inc., from General Bronze Co. points out that the demand for this type of fixture still continues strong. Lighting equipment in sizable volume will be included in the requirements for additions and changes at the Weymouth (Mass.) Hospital, a project which will involve in the neighborhood of $250,000 and is rated an emergency measure on account of the influx of workers in this area as a result of its proximity to important shipyards and a naval base. An additional $75,000 needed for the completion of an extension calling for $200,000, in which a 2,000-kw. diesel generator unit was recently installed is being urged by the Municipal Light Department, Hudson, Mass.

Government supply awards received in this district during the past week include large orders for machine tools for Massachusetts builders, portable electric grinding units, motor-driven saws, unmounted back-connected knife switches to a Worcester, Mass., manufacturer, and vacuum tubes to a prominent Massachusetts manufacturer. Negotiated contracts for cable, aircraft engine parts, and machine tools were placed last week. A contract for installation of a bridge crane at one of the important naval stations on this coast has been awarded to Harnischfeger Corp., Milwaukee, Wisc., at a cost of $99,170.

Manufacturers are entering bids for a wide range of electrical apparatus in government schedules with heating elements, unit heaters, blowers, and small switch and control lots prominent items. A Connecticut firm quoted last week on 500 concentric and 7,500 telephone jacks, another on 1,000 heating elements and 25 air type heaters; a nationally known optical firm has quoted on 100 electric retinoscopes with spare parts and the demand for radio transformers, magnet wire, and radio tubes is steady and strong.

Smaller contracts averaging less than $2,000 are coming more and more into the picture. During the past week awards for electrical apparatus amounting to about $1,200 for outlet boxes, more than $2,000 for refrigerator accessories, small lots of fluorescent fixtures and flexible welding cable in 50-ft. lengths are typical of that trend.

PACIFIC COAST

Construction in San Francisco of 1,000 private dwellings, averaging $5,000 each, has been approved, plus a "substantial quota for conversions," including the necessary priorities on their electrical material.

Building permits for the seven western states totaled $20,194,448 in value for December, 1942, a drop of only about 10 percent below December, 1941, because Oregon and Washington's increase of 300 percent almost filled in California's decrease of 60. However, the seven western state total for entire year of 1942 was about half that for 1941.

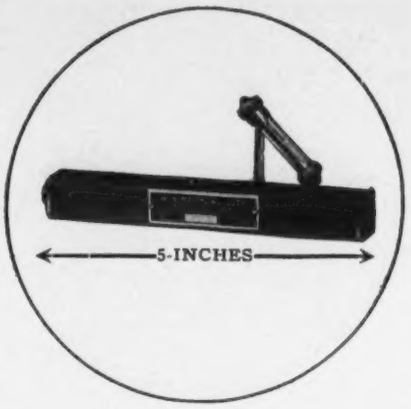
Wholesalers report no apparent diminution in size or quantity of bids for various governmental services, though there are occasional shifts of purchasing weight, such as recent decision to buy certain 9-S Navy specification equipment through Portsmouth, N. H.

Specific orders include a 17-ft. electrical furnace, costing $40,000, for a converted war plant; a marine steam turbine with standby pumps, costing $80,000; three 2,000-kva. substations, totaling $50,000, for overseas shipment; two 13,000-kva. regulating transformers, value $45,000, and ten 2,520-kva. capacitor equipments with circuit breakers, totaling $240,000, for Pacific Gas & Electric Co.

Kaiser is to build more than 200 corvettes at Richmond, and P.C. boat awards, aggregating $2,500,000, have been made to a groups of smaller yards located in the city of Tacoma.

Employment in California manufacturing plants passed the million mark in December for first time in history, recording 1,011,000, an increase of 5 percent over November and 50 percent over December, 1941.

Industrial developments cover Southern Pacific expansions of facilities in Shasta area; a $700,000 addition to a Portland steel mill; rapid progress in concrete shipyards indicated by proposed $3,000,000 housing on nearby site just south of San Francisco; new tungsten and beryllium mines and mills in central Nevada; and several food dehydrating plants in California and Idaho.



No Fallacious Guesses.

There is no guessing with a Matthews Teleheight. Any lineman can be taught to use it and get any height within an inch or so. He can learn in five minutes.

The extra cost of just one wrong guess will pay for one or two Matthews Teleheights. Hundreds of them are saving lots of money for their owners all over the country. Many are being used for quickly figuring the cubical contents of buildings, the clearance of bridges, highlines, etc.

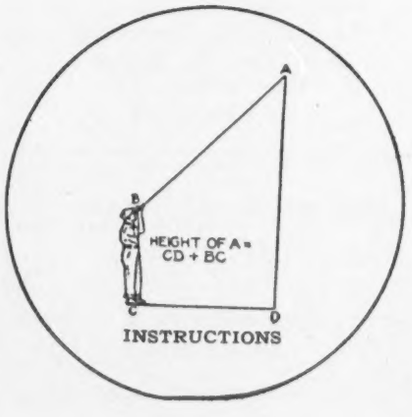
Matthews Teleheight is only five inches long. Has no moving parts. It is furnished with a leather carrying case that will fit in the vest pocket. The drawing below shows how simple are the directions for using it.

Great for Appraisal Jobs.

Try one at our risk of your approval.

W. N. MATTHEWS CORPORATION

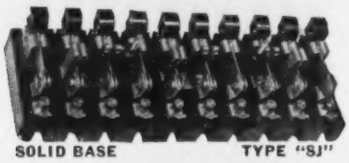
ST. LOUIS, U. S. A.



STATES TESTING EQUIPMENT

TEST BLOCKS

Now, more than ever, Test Blocks for Meter and Relay Installations ARE NEEDED to protect personnel and property.



SOLID BASE TYPE "SJ"

Many are standardizing on STATES Test Blocks because

1. No live parts extend beyond base—an important safety feature.
2. Large selection of pole arrangements.
3. Maximum pressure at jaw contact—and many more distinctive features.

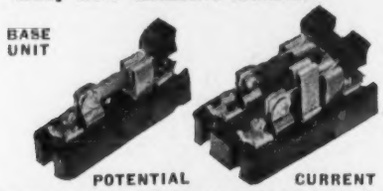


Photo-Electric Watthour Meter TEST TABLE

FORM FRD CAT. NO. 11246

A specially designed Test Table, two meter positions, arranged for utmost efficiency.

Improved Accuracy . . . Less Skilled Operators Required for Better Test Results in Shorter Time

A light beam and relays count the revolutions automatically of the meter under test and start and stop the test meter.

TEAR OFF AND MAIL TODAY TO

THE STATES COMPANY
Hartford, Conn.

Please send description of Form FRD Test Table and full details on Test Blocks.

Name..... Title.....

Firm .....

City..... State.....

Recent Rate Rulings

CENTRAL POWER & LIGHT CO. was sustained in a recent court ruling when the suit of the city of Edinburg (Tex.) against the utility, asking for $40,000 damages and charging the company with failing to provide sufficient data on bonded indebtedness and equipment for ratemaking purposes, was dismissed by Federal Judge Allen B. Hannay.

TAMPA ELECTRIC CO. lost a rate reduction decision when Circuit Judge I. A. Hutchinson filed last month in Tampa a ruling, upholding a Tampa Utility Board's order reducing the company's rates by 30 percent. The court directed the utility company to refund to consumers $1,525,000 collected in excess of rates prescribed by the board. The ruling dismissed company's plea for an injunction and dissolved a temporary order that had prevented the utility board from making new rates effective. An appeal from the ruling is expected. This case has been in litigation since 1940. In April, 1941, the Florida Supreme Court upheld the utility board, but remanded the case to circuit court for final hearing.

ILLINOIS COMMERCE COMMISSION has announced that changes in rates during the year ending December 31, 1942, for services rendered by public utilities exclusive of transportation companies and under the jurisdiction of the commission, resulted in an estimated net annual savings to utility customers aggregating $2,194,393. Of this total electric rate reductions amounted to only $583,159. Cuts in gas rates totaled $1,613,732, the commission report indicates.

ARKANSAS POWER & LIGHT CO. rate disagreement with the First Electric Co-operative Corporation will have to be taken before the Arkansas Utilities Commission by the Rural Electrification Administration as a result of recent ruling by Judge Frank Dodge of the Pulaski Chancery Court, Little Rock, holding that his court has no jurisdiction over a suit filed by the co-operative against the utility. The co-operative had asked an injunction to prevent what it termsd on "unconscionable" increase in rates for electricity supplied for consumption by Perry and Perryville REA consumers.

NEW ENGLAND POWER CO. was recently cited to appear before the Massachusetts Department of Public Utilities to meet a petition by the Worcester (Mass.) Pressed Steel Co. for a reduction in power rates. At the opening hearing the petitioner sought to have the power company file a large number of contracts for electric service to industrial concerns and utilities on the ground that comparisons would demonstrate the equity of a lower rate to the Pressed Steel Company. Contracts with eleven industrial concerns were thus filed, but the utility refused to file contracts obtaining with other power companies unless so ordered by the commission, on the contention that these are irrelevant to the issue. The hearing was continued to February 9 at Boston.

•

Ontario Hydro November Load Increases

Wartime industrial expansion and a gradual lessening in the number of daylight hours caused Ontario Hydro-Electric's primary load to increase more than 54,000 hp. during November, 1942,

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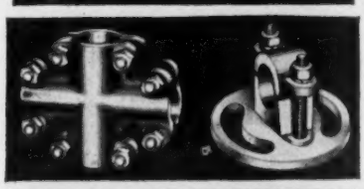

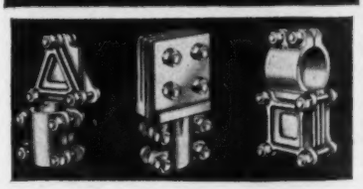

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ver the previous month, according to e monthly load statistics recently re-eased by the Power Commission. The crease also represents a 6.5 percent ain, or 135,000 hp., over the corres-onding month last year, notwithstand-g power conservation by compulsory nd voluntary means.

•

Recent Legislation

Among the new bills drawn up for ction by the various state legislatures re the following:

COLORADO—Creation of a Colorado Power uthority to acquire and operate all priv-ely owned electric and gas systems in he state is proposed in bills offered in oth branches of the General Assembly.

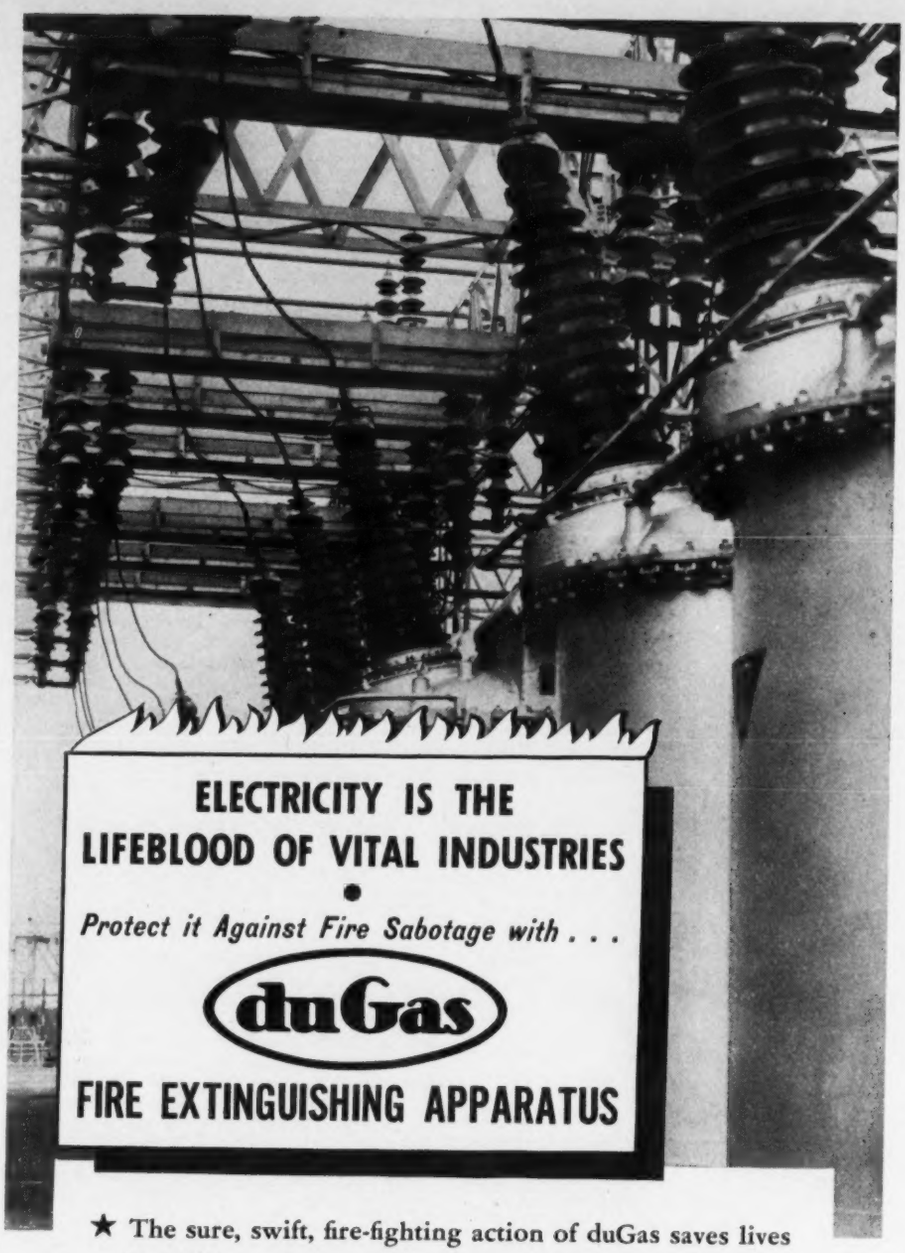
NEBRASKA—A bill has been prepared and ill be introduced soon in the Legislature, aking compulsory the inspection of rural lectric systems in the state. The action as been brought about through the re-usal of a number of government-financed ural electrification districts to permit in-pection of wiring and insulation by the tate Fire Marshal. The proposed law ill empower the marshal to set up re-uired standards for such work and to ee that these are conformed to by all ural electrification districts. A fee for the spection will be established to be uni-rm for all areas. Any person or corpora-on refusing to permit inspection, or which oes not remove or correct condemned quipment will become subject to a fine, ccording to the terms of the new measure.

NEW YORK—Governor Dewey's program ill in relation to diversion of Niagara iver waters for power purposes has been troduced in the Senate by Benjamin F. einberg, Republican of Plattsburgh, and the Assembly by Grant F. Daniels, Re-ublican of Ogdensburg. The bill amends aragraphs 614, 634, 639 and adds new aragraph 612 Conservation Law to em-ower water power and control commission collect from July 1, 1943, equitable ental for diversion of water from Niagara iver of 15,100 cu.ft. per second; diversion any waters from such waters made illegal nless by authority of license from the ommission; all waters of state to which eople have proprietary interest in the flow all be diverted only subject to state's ntrol to regulate, license and charge ntal. Senate Intro. No. 186 creates com-ission of eleven members to examine stat-es and law affecting public waters of ate and water power resources and to ropose changes, modifications and recodi-cation thereof; $75,000 is appropriated d recommendation is to be made on or efore February 1, 1944. Referred to fi-ance committee.

•

WPB Revises Motor Order Ratings

Purchase orders for electric motors d generators rated lower than AA-5 ay no longer be honored by manufac-rers or dealers, WPB has ruled. The mendment, to Order L-221, provides a loor" under ratings for both pieces equipment.



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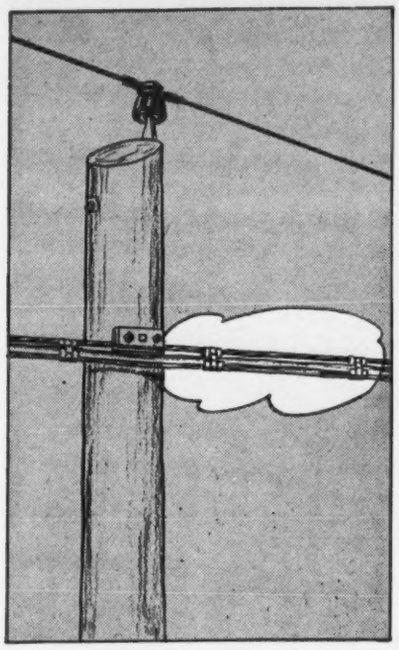

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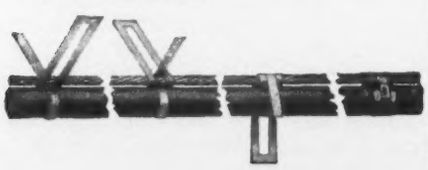

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Sales Opportunities

SOUTH DAKOTA—Northern States Power Co., Minneapolis, Minn., plans extensions in transmission lines. Permission has been secured and work is scheduled to begin soon. It is understood that construction at present time will be of temporary character.

TEXAS—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment. Cost estimated close to $2,000,000, with financing by Defense Plant Corp.

FLORIDA—War Department has authorized new training base, with hangars, shops, warehouses and other industrial structures. Electrical equipment will be installed. A power substation is planned, with electrical distribution system for light and power service. Entire project will cost about $5,000,000 and will be supervised by U. S. District Engineer Office, Jacksonville. Proposed to carry out work soon.

CALIFORNIA—Navy Department has approved plans for new naval air base, comprising hangars, shops, warehouses and other industrial buildings, as well as barracks, mess halls, administration building and miscellaneous structures, totaling in all about 60 units. Electrical equipment will be installed for industrial and commercial service, with power substation and distribution system. Cost estimated over $2,000,000. General contract has been let to Macco-McKittrick Co., a joint interest of Macco Construction Co., 815 North Paramount Blvd., Clearwater, Calif., and E. S. McKittrick Co., Inc., 7839 Santa Fe Ave., Huntington Park, Calif. Contractor has opened temporary offices in Barbara Worth Hotel, Imperial, Calif., to make purchases of required materials and award certain sub-contracts. Edward Springer is purchasing agent; Ray Whinery is project manager.

MICHIGAN—General Motors Corp., General Motors Building, Detroit, plans new plant for production for government. It will comprise several large one and multi-story buildings, with machinery and electrical equipment for heavy output. A power substation is planned. Entire project will cost approximately $12,000,000 and will be financed by Defense Plant Corp.

MASSACHUSETTS—State Department of Public Works, Boston, is considering expansion in airport, including additional hangars, shops and other structures, with complete electrical equipment and facilities for lighting and general operations. Entire project is estimated to cost close to $4,750,000.

TENNESSEE—War Department has authorized new army general hospital, comprising large group of one and multi-story buildings, with shops, mechanical laundry, power substation, refrigerating plant and other utilities. Complete electrical equipment will be installed; also, air-conditioning system. Cost estimated over $3,000,000. Project will be supervised by U. S. District Engineer Office, Atlanta, Ga.

PENNSYLVANIA — International Resistance Co., 401 North Broad St., Philadelphia, manufacturer of resistors, resistance indicators, etc., plans expansion in plant for production for government, including

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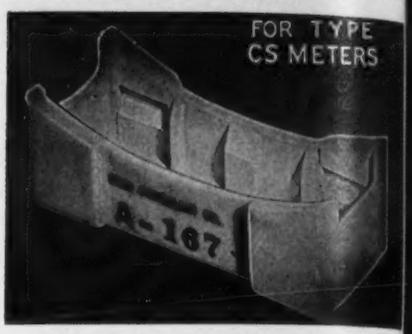

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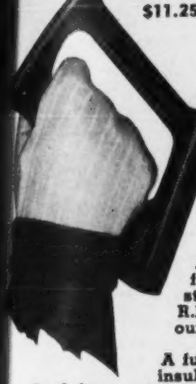

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installation of machinery and equipment for large increased capacity. Cost estimated about $2,000,000, with financing by Defense Plant Corp. Work will be carried out at early date.

ARIZONA—Tucson Gas, Electric Light & Power Co., Tucson, has contracted with U. S. District Engineer Office, Phoenix, for installation of an underground conduit system at an airfield. Work will be carried out at once.

MISSOURI—City Council, Neosho, plans installation of electrically-operated pumping machinery and auxiliary equipment in connection with expansion in water system and filtration plant. Entire project is estimated to cost about $353,500, and will be carried out under direction of FWA. Application has been made for a priority rating. H. T. Lawrence, 3244 N.W. Fourteenth St., Oklahoma City, Okla., is consulting enigneer.

MINNESOTA—City Council, Alexandria, through Civil Aeronautics Authority, Airways Engineering Section, 608 South Dearborn St., Chicago, Ill., will take bids before close of February for proposed municipal airport, including hangars, shops and other structures, with overhead and underground electrical distribution system, complete lighting facilities, control station, etc. Entire project will cost close to $900,000, with financing through federal aid.

CALIFORNIA—Douglas Aircraft Co., Santa Monica, plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment for large increased capacity. Cost estimated at $1,565,000, with financing by Defense Plant Corp. Edward C. and Ellis W. Taylor, 803 West Third St., Los Angeles, are architects and engineers. Work will be placed under way at once.

OHIO—Department of Public Service, Bucyrus, F. C. Judd, director, plans extensions in waterworks station and system, including electrical system and facilities, pumping machinery, boiler unit and other equipment. Cost estimated close to $350,000.

TEXAS—Brazos River Transmission Electric Cooperative, Inc., Itasca, plans extensions in transmission lines in connection with power supply to 13 electric cooperatives forming the organization.

LOUISIANA—Root Petroleum Co., Shreveport, plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment to cost about $980,000. Financing through Defense Plant Corp.

CALIFORNIA—Bureau of Power and Light, Los Angeles, has plans maturing for new one-story mechanical shop, estimated to cost close to $45,000, with machinery and electrical equipment. Work is scheduled to begin soon.

OHIO—Ohio Institute of aeronautics, Inc., 340 East Broad St., Columbus, plans new airport on 185-acre tract, comprising hangars, shops and other structures, with complete lighting equipment and electrical distributing system and facilities. Application has been made for federal approval. G. E. Evans, 40 West Gay St., is engineer; and Denham & Richards, 167 East State St., architects, both Columbus.

MISSOURI—Sanderson & Porter, Inc., 52 William St., New York, N. Y., consulting engineer, will prepare plans for new industrial plant to cost about $2,000,000, with machinery and electrical equipment. Financing by Defense Plant Corp. Work will begin at early date.

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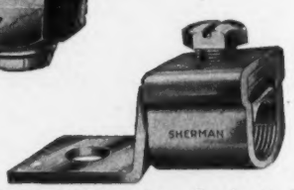

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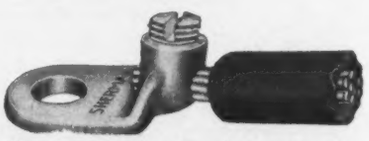

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Four weeks' perfect attendance without absence or tardiness at the factory of the Wiremold Co., Hartford, Conn., may be worth a $25 war bond to any one of 300 production department employees, as the result of a suggestion adopted by the management effective January 4. Each week clock numbers of such employees with perfect attendance for four weeks will be placed in a drum and three numbers drawn.

The first will receive a $25 war bond; the second, $10 in war savings stamps, and the third, $5 in such stamps. The initial drawing, for the period of January 4-30, was to be held February 5. A child of one of the workers drew the numbers, and this will take place weekly hereafter. The objective is to remedy absences which have become widespread in industry on the part of war plant workers, and the suggestion was made by Edith Wootton of the advertising department, who is not eligible for the award.

•

Chicago Electric Group Elects New Officers

At a meeting of the board of directors of the Electric Association, Chicago, C. J. Maloney, district manager of Cutler-Hammer, Inc., was elected president and Fred T. Whiting, northwestern district manager, Westinghouse Electric & Manufacturing Co., treasurer for 1943. Mr. Maloney succeeds G. A. Freeman, vice-president, Commonwealth Edison Co.

•

December Peak Demand

Electric energy requirements of the principal public utility systems of the country during November, 1942, totaled 16,005,565,000 kw.-hr., a gain of 14.5 percent over November, 1941, the Federal Power Commission has announced. November peak demands aggregated 32,149,839 kw., up 5.8 percent over November, 1941. Utility estimates of peak demands for December, 1942, are reported to amount to 34,375,505 kw., representing a decrease of some 541,000 kw. from a similar forecast submitted by the utilities in their October report.

•

Oklahoma Group Elects

Announcement has been made of the election of new officers and directors of the Oklahoma Utilities Association for the year 1943. Officers include: Presi-

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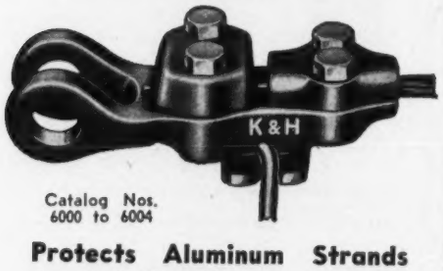

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Protects Aluminum Strands Against Crushing . . . Grips Steel Core Separately . . . Provides Bi-Metal Tap-Off Connector

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•

REA Allots $67,000 Fund to Three States

Allotments by the Rural Electrification Administration of $67,000 to three systems in Nebraska, Oregon and South Dakota have been announced. The allotments to Nebraska and Oregon co-operatives will be used for service extensions to military facilities in the two states. The loan to the South Dakota co-operative was made necessary by unanticipated construction costs on a previous allotment.

Expenditure of funds from these allotments will be made in accordance with regulations of the War Production Board as to use of construction materials. This brings REA allotments to $460,536,345, of which $1,724,000 represents operations during the current fiscal year.

•

Loses Medford Decision

Circuit Judge A. C. Hoppmann has sustained the valuation of $131,000 for the electric utility in the city of Medford set by the Wisconsin Public Service Commission. Lake Superior District Power Co., which serves Medford, had appealed from the commission's order on the grounds that commission experts had worked for the city; that commission examiners has presided over hearings instead of the commission itself and that the amount set by the commission was not a fair price. Judge Hoppmann overruled all of the objections.

•

Earnings Set Record

The largest cash earnings ever credited to the Jacksonville Municipal Electric Department in any one month in the city's history were recorded for the month of December. Incomplete cash payments from electric customers, including miscellaneous income from such sources as electric range repairs and wiring, totaled slightly more than $505,000. These earnings show a decided increase over the December, 1941, earnings, the previous high mark, when $437,000 was paid into the department by electric customers.

Get the right answer *FAST*—*for more efficient more profitable handling of*

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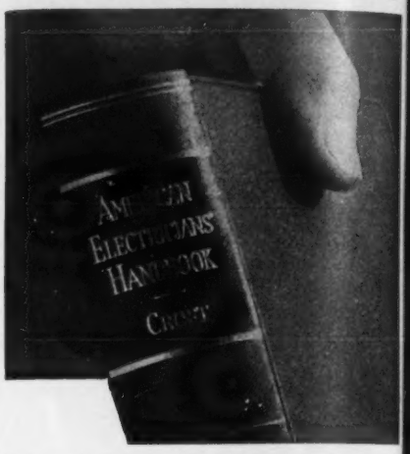

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BOOKS RECEIVED

Television Standards and Practice—First Edition. National Television System Committee, Editor Donald G. Fink. McGraw-Hill Book Co., New York. 405 pages, illustrated. Price $5.

Condensed adaptation of 2,000 pages of minutes of National Television System Committee. A thorough and authoritative examination into the technical bases of a public television system. History, objectives, symposium of answers to 50 questions concerning the subjective aspects. Technical problems of channel, transmitter, scanning, synchronization and polarization.

Communication Circuits. By L. A. Ware and H. R. Reed. John Wiley & Sons, Inc., New York. 397 pages, illustrated. Price $3.50.

Definitely a theoretical and mathematical text advancing from wire transmission, networks, propagation, long lines, filters, equivalence of impedance power circuits (for quantitative contrast) through coaxial channels into ultra-high-frequency wave guides. Appendices: Fourier series, hyperbolic and Bessel functions, Maxwell equations.

Principles of Electronics. By Royce G. Kloeffler. John Wiley & Sons, New York. 175 pages, illustrated. Price $2.50.

Non-mathematical introductory treatment of the physics tenets underlying electronics followed by semi-quantitative discussion of thermionic emission, rectification, triode characteristics and applications, tetrodes, X-ray, magnetron and photocells. A brief chapter on radio applications.

Basic Principles of Weather Forecasting. By Victor P. Starr. Harper & Brothers, New York. 179 pages, illustrated. Price $3.

From the Institute of Meteorology of the University of Chicago this discussion of the cooling and technique of short-range forecasting is systematic in enunciation of the complex problem and in the exposition of new methods of analysis, deduction and prognostication. Particular emphasis is based on prediction from one-station data. Equal emphasis is placed on the experience aspects of forecasting. Much of the text is devoted to a discussion of representative maps both in the mathematical language of thermo- and hydrodynamics and in the phrasing of the logician. By no means an elementary book, it need not prove so erudite as to escape being a stimulating aid to the amateur electric utility forecasters who want to anticipate glaze formations, flash floods and hurricanes, as well as the measure of precipitation to be stored behind hydro dams.

Transients in Linear Systems—Volume I. By Murray F. Gardner and John L. Barnes. John Wiley & Sons, Inc., New York. 389 pages, illustrated. Price $5.

An M.I.T. text for graduates in mechanical and electrical engineering. Mathematical analysis of transients, desired and undesirable. Emphasis is on the Laplace transformation. Basic treatment applicable to surges, faults, short circuits, tube circuits, transients of welding, of inductive coupling, of heat flow and of magnetic fields in solid iron cores. Encourages unified approach to homologous phenomena in companion fields of engineering. Appendix has summary of theorems and tabulation of transform-pairs.

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Must be thoroughly familiar with all types of electric motors, starters, controls, etc. Need not be graduate engineer, but must have proven sales and executive ability. Please give complete details in first letter.

Permanent position at substantial salary to right man. Please do not answer unless you meet fully the requirements outlined.

P-500, Electrical World,
520 North Michigan Ave.,
Chicago, Ill.

POSITION VACANT

CAPACITOR ENGINEER—College graduate in electrical engineering having design and manufacturing experience with capacitors to take charge of Capacitor Dept.—old established firm—permanent position—location middlewest. Give full particulars regarding yourself in first letter. P-509, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVE AND TECHNICAL MEN. Qualified candidates desiring $2,500 to $20,000 position may contact employers through our confidential services, established 27 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

POSITION as superintendent of municipal utilities, twenty years experience with steam and diesel generating equipment and distribution systems. PW-331, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL AND STRUCTURAL ENGINEERS, experienced power house, substation, and transmission line designers, immediately available. Public utility engineers completing authorized construction projects will gladly arrange interviews and otherwise bring your requirements to such men's attention. PW-501, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER (1938 Pratt Graduate) available now for essential war industry located within Metropolitan New York commuting area, on field research; product development; liaison; or as expeditor, etc. Experience includes 5½ years technical writing, reporting; photography for electrical trade paper. Age 28; married; 1 child. U. S. citizen. 3A. PW-505, Electrical World, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

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WANTED

WANTED By Established Electrical Manufacturer—New type electrical fittings or products in conjunction with same, that are used by Electric Utilities for post-war manufacture. Patented articles preferred but not essential. W-507, Electrical World, 330 W. 42nd St., New York, N. Y.

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200 KW West. No. 201 SK comp. wound, 600 V D.C. with 290 HP syn. motor, 3/60/2200 and 900 RPM
200 KW Buckeye Diesel Engine & Generator 3/60/240
500 KW Terry Steam Turbine Generator 3/60/240 with barometric condenser
1000 KW G.E. Type ATB-2-1250-3600, Form T, 814 amps. 3/60/2200-900 RPM
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1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

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2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
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200 KW, 600 volt, GE, sq. cg.
250 KW, 250 v., GE Synch.
200 KW, 125 v., Wsgh., Sq. Cage
100 KW, 125 v., GE Sq. Cage
100 KW, 125 volt, Electric Products, syn.

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500 HP, 1200 RPM, 440 volt, GE, syn.
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335 HP, 600 RPM, 2300 volt, GE, syn.
300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
250 HP, 514 RPM, 4000 volt, G.E., syn.
250 HP, 600 RPM, 4000 volt, G.E. Sync.
200 HP, 900 RPM, 440 volt, Westg., sl. rg.
200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
150 HP, 720 RPM, 440 volt, G.E., slip ring.
150 HP, 600 RPM, 440 volt, G.E., slip ring.
150 HP, 400 RPM, 440 volt, G.E., sq. cg.
125 HP, 720 RPM, 440 volt, G.E., slip ring.
100 HP, 900 RPM, 440, Westinghouse, sq. cg.
100 HP, 900 RPM, 440 volt, G.E., slip ring.
100 HP, 720 RPM, 440 volt, G.E., slip ring
100 HP, 720 RPM, 440 volt, G.E., sq. cg.
100 HP, 600 RPM, 440 volt, G.E., slip ring.
100 HP, 600 RPM, 440 volt, G.E., sq. cg.
100 HP, 514 RPM., 440 volt, G.E., sq. cg.
100 HP, 450 RPM, 440 volt, G.E., sq. cg.
90 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
75 HP, 900 RPM, 440 volt, GE, sq. cg.
75 HP, 720 RPM, 440 volt, Westghse, slip ring.
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1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM. 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

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600 KW Terry dual bleeder condensing Turbine only.
1—500K W, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

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2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, Westinghouse, 5500/440 volts.
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3—150 KVA, G.E., 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G E., 220/110-220/110 volts.
2—15 KVA, G E., 2300-115/230 volts.
4—10 KVA, G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

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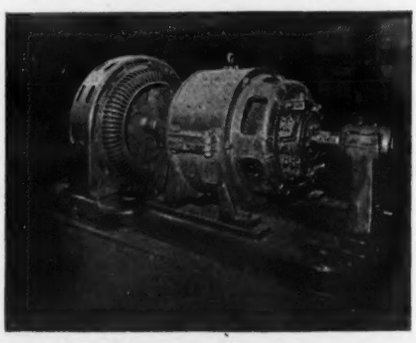
1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



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*Allen-Bradley Company 81, 82
*Allis-Chalmers Mfg. Co.....10, 11
Anaconda Wire & Cable Co..... 30
*Artkraft Sign Company..... 107
Automatic Alarms, Inc..... 117

Barker & Wheeler..... 116
Black & Veatch..... 116
Brewer-Titchener Corp. 21
*Bright Light Reflector Co., Inc.. 92
Broadway Maintenance Corp..... 116

Cardox Corporation 104
Chase-Shawmut Co., The..... 31
Cheney & Co., E. J..... 116
Columbia Engrg. Co..... 116
*Connecticut Hard Rubber Co..... 115
*Continental-Diamond Fibre Co.... 26
Cooper & Co., Hugh L..... 116
Crescent Insulated Wire & Cable Co. 93

Day & Zimmermann, Inc..... 116
Directory of Engineers..... 116
Dugas Engrg. Corp..... 113
*Dunn, Inc., Struthers..... 91

Electric Controller & Mfg. Co..... 24
Electrical Testing Laboratories, Inc. 116
Electroline Company 5
Elliott Company 6
Engineers, Directory of..... 116
Everstick Anchor Co..... 115

*Fairbanks, Morse & Co..... 27
Ferguson, H. F..... 116
Foley Construction Corp., Robert E. 116
Ford, Bacon & Davis, Inc..... 116
Fowle & Co., Frank F..... 116

*G. C. A. Mfg. Co..... 117
G & W Electric Specialty Co..... 23
*General Electric Co.....32, 66, 67, 70 71
General Electric Co., Air Conditioning and Commercial Refrigeration Dept. 12
Gilbert Associates, Inc..... 116
Grinnell Co. 102

Handy & Harmon..... 106
*Hazard Insulated Wire Works.... 4
Henkels & McCoy..... 116
Hoosier Engineering Co..... 116
*Hoskins Manufacturing Co..... 16
Hubbard & Co..... 95

*Ideal Commutator Dresser Co..... 105
*Imperial Porcelain Works..... 117
Indiana Steel & Wire Co..... 96
*I-T-E Circuit Breaker Co..Third Cover

Kelvinator Division of Nash-Kelvinator Corp. 89
Kerite Insulated Wire & Cable Co., Inc. 34
*Klein & Sons, Mathias..... 110
*Krueger & Hudepohl..... 118

*Lapp Insulator Co..... 25
Leffler, William S..... 116

*Macallen Co. 20
Main, Inc., Chas. T..... 116
Manning & Co., J. H..... 116
Marmon-Herrington Co., Inc..... 85
Matthews Corp., W. N..... 111
McGraw-Hill Book Co.....90, 118
Mead, Daniel W..... 116
Miller Company, The..... 18
*Mitchell-Rand Insulation Co., Inc. 98
*Monitor Controller Co., The..... 87
Mullergren, Arthur L..... 116

*National Varnished Products Corp., The 118

Ohio Brass Co..... 13
*Okonite Co. 4
*Okonite-Callender Cable Co..... 4
*Pacific Electric Mfg. Corp..... 3
*Penn-Union Electric Corp..... 12

*Railway & Industrial Engineering Co. .....
Recording & Statistical Corp..... 11
*Reliable Electric Co..... 11
*Rockbestos Products Corp..... 7

Sanderson & Porter..... 11
Sargent & Lundy..... 11
Scheidenhelm, F. W..... 11
Searchlight Section 119, 120, 12
*Sherman Mfg. Co., H. B..... 11
Simplex Wire & Cable Co..... 7
Socony-Vacuum Oil Co., Inc..... 1
Spooner & Merrill, Inc..... 11
Standard Oil Co. (Indiana) .Back Cover
*Star Porcelain Co., The..... 11
*States Company, The..... 11
Stone & Webster Engrg. Corp..... 11

*United States Steel Corp..... 10
Universal Atlas Cement Co..... 10

Welsbach Engrg. & Mgt. Corp.... 11
Western Electric Co..... 1
*Westinghouse Elec. & Mfg. Co...17, 2 29, 79, 9
*Westinghouse Elec. & Mfg. Co. Lamp Division 8, 9
*Westinghouse Elec. Supply Co.... 10
*Weston Electric Instrument Corp. Second Cover
White Engrg. Corp., J. G..... 11
Widmer Engineering Co..... 11
*Wolfe & Mann Mfg. Co..... 1
*Wolverine Tube Div., Calumet & Hecla Cons. Copper Co..... 2

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PROFESSIONAL SERVICES 11

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SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT SERVICE .....
POSITIONS VACANT .....
POSITIONS WANTED .....
WANTED TO PURCHASE.....
USED AND SURPLUS EQUIPMENT.....120-12
Belyea Co., Inc.....
Brew Woltman & Co.....
Chicago Electric Co.....
Consolidated Gas Elect. Lt. & Pr. Co.....
Electric Service Co., The.....
Erie Electric Co.....
Hemphill & Co., L. J.....
Iowa Nebraska Lt. & Pr. Co.....
Iron & Steel Products Inc.....
San Diego Gas & Electric.....

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

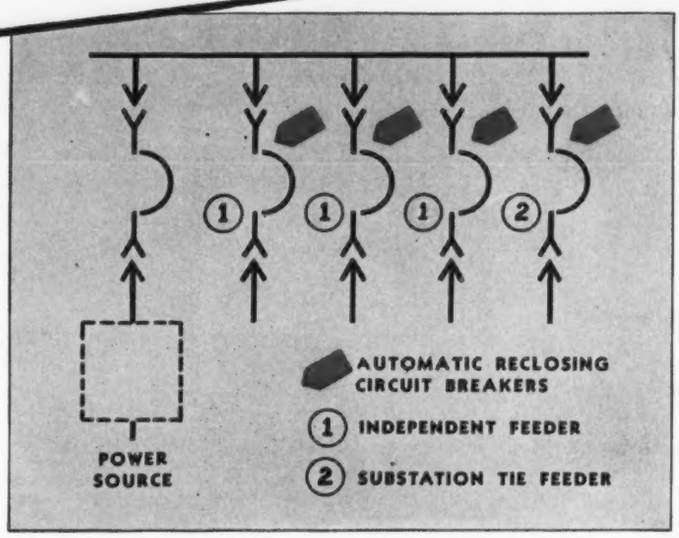
News of Electrical Protection

Wider Industrial Use of Automatic Reclosing Circuit Breakers

AMONG ENGINEERS in industrial plants, there is evidence of growing interest in the advantages of automatic reclosing circuit breakers. Much of the interest centers on applications for d-c systems in which, after outage, it is safe and otherwise desirable to have service restored at the instant a fault has been cleared.

Wider use of unattended substations, where automatic reclosing is necessary, has helped in some degree to popularize the automatic type of equipment. But the basic causes are the immediate and long-range values that engineers now see in providing means to assure the best continuity of service. War-time pressure for peak production is proving to many men, more pointedly than ever before, the sound and lasting economy of avoiding needlessly prolonged interruptions.

Automatic reclosing of circuit breakers is a thoroughly established art. On mining and street-railway systems, I-T-E has literally hundreds of installations. The equipment localizes faults –confines a disturbance to that portion of the system on which it arises. As soon as conditions are right, the circuit breaker itself restores the power.



Schematic diagram indicating use of automatic reclosing circuit breakers on feeders and for sectionalizing a tie-line to another substation.

Make a note about automatic reclosing circuit breakers. Industry will be using more of them. Keep them in mind for long-range plans. I-T-E engineers, whose experience dates from the pioneering installations years ago, will help you.

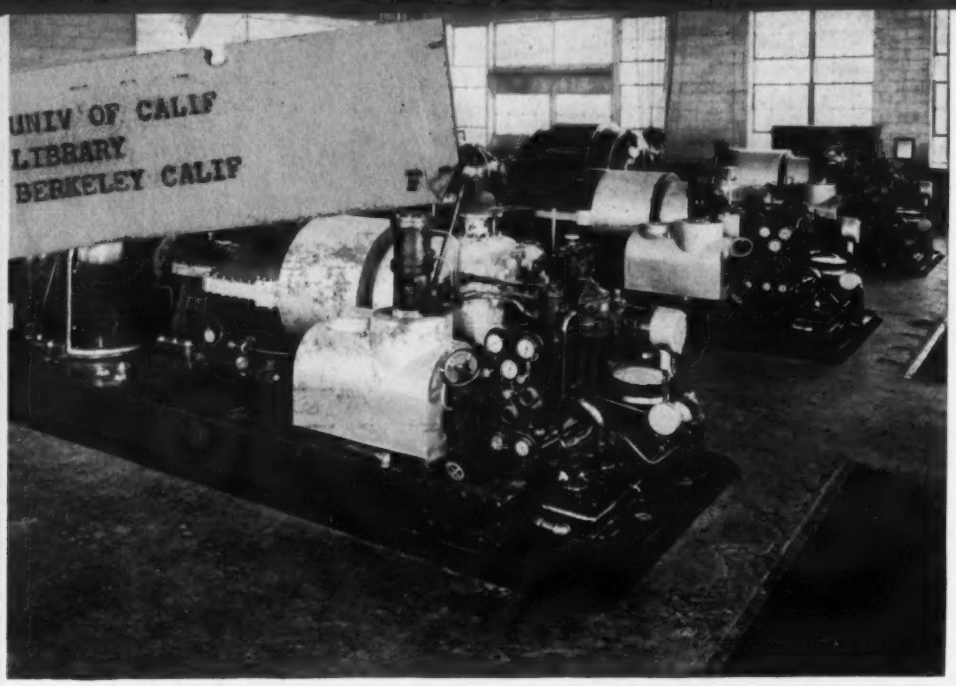
Representatives in Principal Cities

AIR SWITCHGEAR

IMMERSED IN AIR — ENCASED IN STEEL

The Army-Navy "E" for Production Excellence

I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.



Records made on the three turbines above show how clean turbine oil systems stay with Nonpareil Turbine Oil.

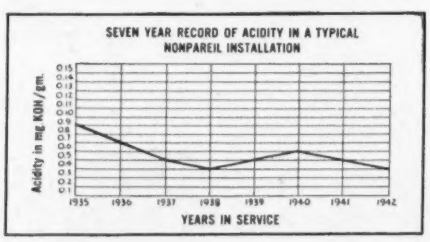
Service record shows how to get cleaner turbine operation

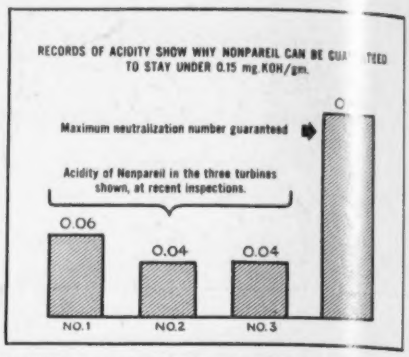
A comparison of turbine oil operation is difficult to make. Conditions vary from plant to plant. The type of turbine, and operating practices and needs affect oil performance. But here is a case where conditions were, as nearly as possible, identical—where the performance of an oil that is fully protected against acidity and sludge formation could be fairly rated in direct comparison with a conventional oil.

Here are the conditions. The three 1500 KW turbines in a middle western power plant, shown above, are the same make. All operated eight years on Nonpareil Turbine Oil. All maintained an excellent record for low acidity and cleanliness. Then, for reasons not connected with the oil, the No. 3 turbine (extreme right in the picture) was filled with a conventional oil. And troubles started popping. Bearing temperatures rose. Sludge clogged oil screens. Oil had to be centrifuged continuously.

Another turbine was tried. When the troubles continued, it was thought that some mechanical difficulty in the turbine might be the cause. At the yearly overhaul period, No. 3 turbine was put back on Nonpareil, and turbine No. 1 was filled with a new batch of the conventional oil. The troubles switched over to No. 1. Bearings overheated; screens clogged and had to be cleaned every 60 days.

Back to normal. In the meantime, turbine No. 2 which had operated continuously, and No. 3 which had been refilled with Nonpareil, were giving no trouble. Acidity was low, and screens and coolers were cleaned only at the yearly inspection period. That was enough evidence for this operator. Nonpareil Turbine Oil is again in all three units.




RECORDS OF ACIDITY SHOW WHY NONPAREIL CAN BE GUA TEED TO STAY UNDER 0.15 mg KOH/gm.
Maximum neutralization number guaranteed
Acidity of Nonpareil in the three turbines shown, at recent inspections.
0.06
0.04
0.04
NO.1
NO.2
NO.3

Acidity control in Nonpareil. The low acidity of Nonpareil in the three turbines, as shown by the figures above, is obtained by the use of a *patented* inhibitor which is added to a highly refined oil from which the asphaltene-forming hydrocarbons have been removed. This also accounts for the unusually clean operation secured with Nonpareil. Its neutralization number is *guaranteed*, in writing, not to exceed the low limit of 0.15 mg.KOH/gm. for the life of your turbine.

COMPARISON OF SERVICE REQUIREMENTS BETWEEN NONPAREIL AND COMPETITIVE OIL

Noted during the period when turbine No. 1 was operating on a competitive oil and turbine No. 2 was operating on Nonpareil.

	Nonpareil	Other Oil
Oil Centrifuged . .	Every 30 days	Continuously
Screens cleaned . .	Yearly	Every 60 days
Oil replacements .	None	Yearly
Bearing temp. . .	140°—145°	160°—165°

Get all the facts. A Standard Lubrication Engineer can tell you many other operating advantages of this patented type of turbine oil. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska, at Omaha.

★ NONPAREIL TURBINE OIL ★

OIL IS AMMUNITION . . . USE IT WI LY.

STANDARD OIL COMPANY (INDIANA)

★ LUBRICATION ENGINEERING